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DIRECTIONS FOR WORKING.

EXPOSURE.—For contact work from a negative of ordinary density, and employing an ordinary gas burner as the source of light, an exposure of about three seconds at a distance of eighteen inches from the flame.

For enlarging, either by daylight or artificial light, it is recommended to make a trial exposure upon a small piece of paper.

DEVELOPMENT.

Having made the exposure, immerse the paper face upwards in water until thoroughly soaked, then drain off, and *immediately* flow the developer evenly over the surface. *Insufficient soaking is the cause of air bubbles producing white spots.* (For small prints it is preferable to flow the developer over the dry exposed paper.)

We advocate Amidol as being the most reliable developer for general purposes, although any other may be used.

AMIDOL DEVELOPER.

Amidol	...	...	...	50 gr.
Sulphite Soda	...	...	...	650 "
Potass Bromide	...	...	...	10 "
Water	...	...	...	20 oz.

This Developer should be used within three days of mixing.

METOL DEVELOPER.

Metol	...	...	...	50 gr.
Hydrokinone	...	...	...	15 "
Sulphite of Soda	...	...	...	500 "
Potass Bromide	...	...	...	10 "
Potass Carbonate	...	...	...	100 "
Water	...	...	...	20 oz.

Dissolve the Metol in the water first.

This Developer keeps well.

The same solutions may be used for two or more prints in succession.

As soon as development is complete (which for a normal exposure should take about two minutes), the print should be transferred without previous washing to the following *acid fixing bath*, where it should remain for at least five minutes :

STOCK SOLUTION.

Sulphite of Soda	...	...	...	...	...	1 lb.
Sulphuric or Acetic Acid	...	...	...	...	...	2 oz.
Water to make	...	...	...	...	...	80 oz.

ACID FIXING BATH.

Hyposulphite of Soda	...	...	...	...	...	2 oz.
Stock Acid Sulphite Solution as above	...	...	...	...	...	1 oz.
Water	...	...	...	...	...	20 oz.

ENAMMO.

To obtain a highly glazed surface on this paper, squeegee the wet print, face down, onto a polished ferrotype plate, and allow it to remain until dry, when the print will peel off.

Surface markings, scratches, &c., to which this paper is sometimes liable, can be easily removed by rubbing the surface while still wet with a tuft of cotton wool.

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$6\frac{1}{2} \times 4\frac{1}{2}$	...	"	16 "	
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DIRECTIONS for working SYLVIO P.O.P.

CAUTION.—To ensure success this paper must be kept perfectly dry, and being more sensitive to light than the old albumenized paper, special care must be taken to handle it in a subdued light only.

WASHING.—The prints must be *thoroughly* well-washed, for at least 10 minutes, in many changes of water, previous to toning.

TONING.—The following Phosphate Bath is the best for obtaining most lovely warm or purple tones.

PHOSPHATE TONING BATH.

Phosphate of Soda	...	...	...	...	...	60 gr
Gold Chloride	...	...	...	...	...	2 "
Water	...	...	...	...	...	40 oz.

This bath should be allowed to stand one hour before using; it will not keep. The above quantity is sufficient for 24 half-plates.

CAUTION.—Care should be taken not to overtone, as prints become darker when dry. Judge the tone by the surface of the print and not by looking through it. For warm tones the prints must be decidedly red in leaving the toning bath; for purple tones there should be still a slight trace of red left.

The prints must now be well washed and then fixed in the following bath, where they should remain for not less than 10 minutes.

FIXING BATH.

Sodium Hyposulphite	...	...	...	...	...	2 oz.
Water	...	...	...	...	...	20 "

After fixing, wash thoroughly in running water for at least one hour. The prints may then be hung up to dry by means of clips, or to obtain a highly glazed surface, squeegee them onto a ferrotype plate and there allow to remain until dry. On no account should they be placed between blotting paper.

COMBINED TONING and FIXING BATH.

To those preferring a Combined Toning and Fixing Bath, the following will be found to give very beautiful results.

To prevent any chance of the prints yellowing by age we recommend they should be immersed first in a bath of

Sodium Sulphite	...	...	...	...	...	200 gr.
Water	...	...	...	...	...	20 oz

where they should remain for 10 minutes. They must then be *thoroughly* well washed in many changes of water, and may be toned in the following:

STOCK SOLUTION.

A. —Sodium Hyposulphite	8 oz.	B. —Gold Chloride	...	15 gr
Citric Acid	...	Water	...	15 dr.
Alum (ordinary)	...			
Lead Acetate	...			
Water (hot)	...			
	200 "			
	20 "			
	30 oz.			

A.—Dissolve the Hypo first in the hot water, then add with stirring the other ingredients in the order named. Allow to stand until cold, and decant or filter off the clear liquid.

For use take Stock Solution **A** 6 ounces; Stock Solution **B** 1 drachm.

Allowance should be made not to carry toning too far, as the prints are colder in tone when dry.

Wash in the usual way.

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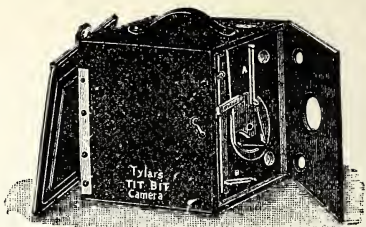
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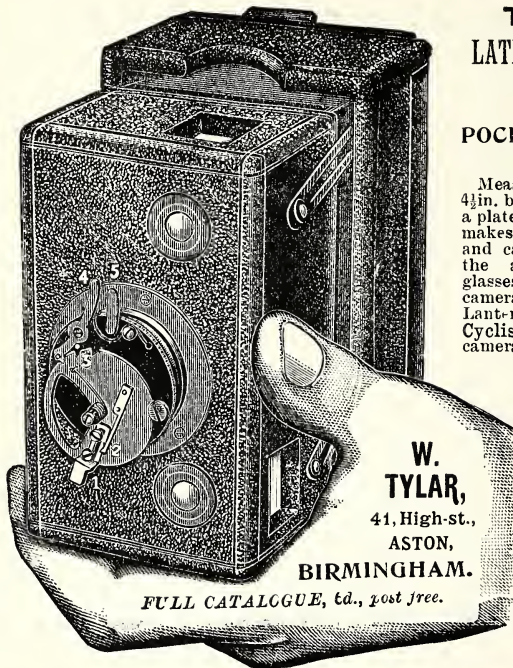
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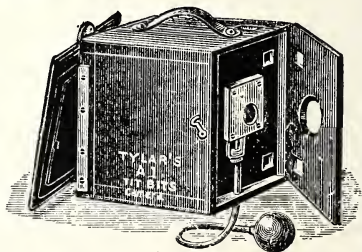
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PREFACE.

THE chief aims of this book are to briefly explain how to print, by means of light, upon the leading kinds of paper which are now in favour, and further to point out what are the respective advantages and disadvantages of the various Photographic Printing Methods referred to.

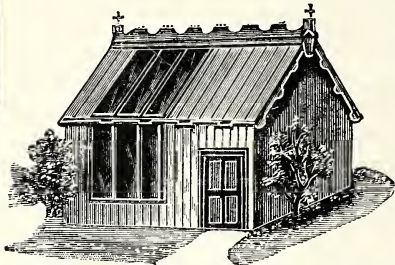
Comparatively few photographers have a practical knowledge of more than one particular kind of paper, nor are they even, in all cases, aware of the variations in treatment which are available in the working of that particular paper which they habitually rely upon. And so, using my eight years' experience as President of the Croydon Camera Club, during which time I have practised and seen others practise, all, or nearly all, the methods herein written of, I have set down simple, elementary information about such photographic printing and toning procedures as are to-day the fashion.

In conclusion, I have to acknowledge an indebtedness to many friends for hints and suggestions; more particularly to Mr. F. P. Wratten, A.R.C.S., who, besides helping in the revision of the sheets of this volume, has kindly contributed a valuable section dealing with the latest developments of photo-printing by means of the bichromate salts. Mr. Wratten's researches and discoveries in those new and promising departments of pigment printing associated with the names of Messrs. Artigue, Henneberger, Maskell, and others, lend additional weight to his remarks.

My thanks are also tendered to Messrs. Wellington and Ward for the admirable frontispiece printed by them upon their platino-matt bromide paper; to Mr. G. W. Jenkins for a set of prints reproduced in Chapter IV.; and to Mr. A. E. Isaac for help in correcting the proofs.

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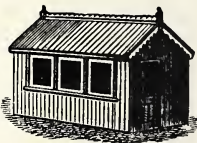
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CHAPTER I.

SOME REASONS WHY ONE SHOULD READ THE FOLLOWING CHAPTERS.

Fashion in Photo-Printing.—Few things are more evanescent in the domain of pictorial art than the fashion as regards Photographic Printing. For many years there has been an unceasing change in the effects aimed at, and in the materials employed; during which period minute definition has alternated with extreme fuzziness, fine gradations have played bo-peep with blotty silhouettes, and mirror-like surface has been supplanted by the rugosities of a ploughed field; whilst, as regards colour, the vagaries of our leaders have pretty well exhausted the rainbow. And so of the pictorial print—especially the exhibition one—we may say, it has been “all things by turn and nothing long.” At the same time there has been enlisted a huge army, calculated at about one million amateurs, besides many

professionals, who practically know absolutely nothing except how to print in one particular way, and that way often not the best for what they have in view.

P. O. P. and the Combined Bath.—If the Photographic World could be polled, it would, I suppose, be found that the majority use what, in the slang of the day, they call “P. O. P.,” by which they would mean gelatino-chloride paper. Again, of those who use this paper, perhaps more than half also use what they call the combined bath (of gold and hypo), but which in many cases is, as far as its action goes, an uncombined bath, in the sense that practically no gold is deposited upon the printed image.

Now the use of both the above two expedients for getting prints is probably as ill-advised a proceeding as any amateur or professional who respects himself and his work could adopt. Even if P. O. P. and the combined bath were as praiseworthy as they are not, and were to remain fashionable for all future time, which they certainly will not do, there would yet remain strong reasons why the photographer should learn to use other printing papers; for, as will be shown later on, there are many circumstances connected with subject, class of negative, period of year, rapidity of execution, cost, and permanency, besides numerous other reasons, why one or another particular process should be preferentially employed, as occasion calls for.

Old Processes Revived.—Although, as already stated, the fashion is continually changing, the reader must not thence conclude that familiarising himself with processes which to-day happen to be out of vogue will mean waste of energy. For such are the revenges of the whirligig of Time, even in photographic affairs, that we are constantly noting the revival of one or another of bygone printing procedures. Of this no stronger example could be wished for than the present great popularity, amongst the leading exhibitors, of Poitevin's Carbon Printing Process, which, first published, and to some extent practised, over forty years ago, was soon superseded by the Swan and Johnson Carbon

processes about 1864-9, and then, apparently, for ever relegated to the limbo of the all-forsaken. And yet the finest picture in the 1897 Exhibition of the Royal Photographic Society was done upon this long discarded printing paper, slightly modified. I refer to "A Study," by Philipp von Schoeller. Another case in point is that of collodio-chloride of silver paper. Introduced by Wharton Simpson in 1865, it was displaced first by albumenised paper and next by gelatinised paper; but, if indications are not delusive, collodio-chloride paper is destined to shortly take the lead of all print-out silver papers. (See "A Promising Printing Process," by myself, in *The British Journal of Photography*, Vol. XLII., p. 389.)

The Need of Knowledge Respecting Various Processes.—Whilst advocating a wide practical acquaintance with various means of photo-printing let me answer an objection likely to be held by some, viz., that it is better to be master of one method than Jack of many methods. There is no good reason why a photographer should not be both, Jack of many and master of one; indeed, it is not impossible for a much devoted printer to be master of most of the leading printing procedures. Any way, as I have pointed out *in respect of negatives* (Address to Croydon Camera Club, October, 1896), to be merely master of one make is not good enough, for it is, in these days of hypercriticism and keen rivalry, absolutely necessary that negatives should be suited with that printing tone and surface as is judged to be most in consonance with their character, and as will best emphasise their particular charm or best diminish their particular shortcoming.

Suiting a Negative to a Printing Process.—To particularise is surely needless, for who, having seen the Bartolozzi red of the carbon portrait studies, the glowing sepia-types of old carved oak interiors, the green-grey in Worsley-Benison's sea studies, or the blue-grey of Paul Martin's "London by Night," would doubt that in each case subject should have the first say in determining the printing process.

Apart from such qualities as colour and surface, a

command of various papers, as well as a somewhat intimate knowledge of how to make the most of them, is often called for, because of the abnormal printing character of a negative. Later on some words will be devoted to the preparation and modification of a negative in order to get as good a print as possible; and a vast deal can be done in this way by the intelligent use of chemical and physical methods. Even so there is a limit beyond which, in practice, one cannot go; this reached, there remains only to choose the printing process which will best translate the scales of opacity in the negative into a harmonious, truthful, and telling rendering of light and shade.

Besides the limit, which is soon reached, when one seeks to modify a negative there is generally some danger, especially where half ignorant, or utterly careless, individuals are concerned, that the negative may be irretrievably ruined. Although the celluloid negatives, both flat or rolled, are not so liable to breakage as are glass ones, they are very much less amenable to many of the manipulations possible with glass, and are in any case difficult to handle and to preserve from marking on the gelatine surface.

Variety of Tonality Rendered by Different Papers.

—This is not the place to dwell upon the comparative scales of printing densities rendered by various papers, as this will be done in its proper section. Enough that a print which may be hard and harsh upon gelatino-chloride paper will possibly be quite satisfactory upon albumenised paper; while a print which is too flat when printed upon albumen may come very well indeed upon gelatino-chloride (P. O. P.).

Difficulty of Making Negatives to Suit Paper.—

Instead of suiting the printing process to the negative, many suit, or try to do so, the negative to the printing process. Similarly makers make plates, and recommend formulæ which are calculated to produce *cliches* that will print well upon the fashionable paper of the day. In spite of this, there exists a native erraticism in ordinary photographic practice which defeats all plans, and ensures a plentiful supply of negatives which are far from attaining the ideal

standard one could wish for. There are in the exposure and development of a negative so many reasons—one or more of which being mostly present—why error should creep in, that it may be accepted as granted that a sequence of negatives enjoying the maximum possible correctness of printing quality which is capable of being fully and easily rendered by any one printing paper, is extremely rare.

CHAPTER II.

MATERIALS AND APPARATUS USED IN PRINTING.

Cost of a Printing Outfit. — “How much will a printing outfit cost?” is the first question many will ask. The answer is, Any sum you please, from about 2s. 6d. to £50, or even more.

Supposing that the photographer already possesses the dishes and chemicals for making negatives, then all that he will in addition absolutely need for gelatino-chloride (P. O. P.) printing will be, for $\frac{1}{4}$ -plate prints, two white porcelain dishes (cost 1s. 6d.), one printing-frame (cost 6d.), and 2dr. of a concentrated solution of sulphocyanide of ammonia and gold (cost 6d.); total, 2s. 6d. The rest is luxury or, say, refinement. Other forms of printing outfit are equally cheap; thus a $\frac{1}{4}$ -plate size platinotype one need not cost more than 3s., including printing-frame, iron dish, porcelain dish, hydrochloric acid, and potassium oxalate. Bromide paper needs no more than does the gelatino-chloride. Carbon printing can be done from start to finish for about 4s., and other processes for photo-printing on paper are even cheaper. Thus cyanotype needs absolutely nothing but a printing-frame.

Comparison of Cost of Printing Paper.—The above estimates do not include the cost of the paper printed upon, which, however, is very small; thus in $\frac{1}{4}$ -plate sizes gelatino-chloride paper costs about 3d., collodio-chloride about $4\frac{1}{2}$ d., bromide paper about 5d. to 6d., carbon “tissue” 5d., platinotype 9d. per dozen sheets, each measuring $4\frac{1}{4}$ in. by $3\frac{1}{4}$ in.

Interchanging Apparatus for Various Processes.—After reading the above some may consider it needless labour

to dwell at any length upon the materials and apparatus used in printing. But the foregoing estimates provide only for the meagrest kind of printing; they merely suffice to enable the amateur to obtain a few occasional prints, or to permit of an experimentalist, or a tyro, trying any printing process the elements of which he may desire to master.

Those who, reading this book, are thereby induced to familiarise themselves with a number of the printing methods described, will, of course, not need to replace most of the apparatus or materials used in any one process when trying the others. Thus printing-frames, toning, washing, fixing, and other dishes may often be employed in succession for several different printing procedures. For instance, gelatinised, albumenised, or collodionised papers can be toned, washed, or fixed, not advisedly together, nor in the same bath, but in the same set of three dishes, after very slight rinsing. Bromide paper can also be developed in the same dish that has been used for developing a negative; the more so if the same developer is employed for both, such as metol or amidol. But on no account may the iron developer (ferrous oxalate) be used in a dish employed for the above developers, or for pyro, or for any similar developer. Nor may silver prints be toned with a "separate bath" in a dish previously used for toning and fixing by means of the "combined" bath. Such are some amongst the cautions to be observed when one desires to make a dish do double or treble duty.

The amateur who wishes to follow up with earnestness and energy any one, or more, photo-printing process, or the professional who has to turn out a large number of prints, many of great size, will find that there are numerous costly aids which are well worth paying for. It is not proposed, however, to attempt to indicate how large sums may be profitably spent, but rather to describe a few out of the many helpful contrivances for printing which are at the photographer's disposal. In doing which it will be assumed that the reader is ignorant of everything connected with this section of the subject.

Dishes.—Of these there are a very large variety, differing in one way or another. Here a few words regarding

their colours. As a rule, white or cream dishes will be found the best. First, their cleanliness is easily noted; secondly, the colour of the contained solution is more readily recognisable; thirdly, prints which when wet are apt to become to some extent translucent are less affected than if a dish were, say, black, in which case the high lights would seem darker than they really were. In some cases, however, a less actinic colour is to be preferred—not so much where prints are under consideration, as with highly sensitive dry-plates. Absolute black, as are papier mâché dishes, is also in its way useful. Thus, when dia-positives (transparencies on glass) are made, it frequently, perhaps generally, ensues that, in order to get the best possible result, a slight reduction of the print is called for. If such a plate be placed in a dark dish and rocked, one can quickly see when the high lights are thoroughly cleared by the dark surface of the dish showing through the light-coloured film.

For toning ordinary silver prints with gold, platinum, and other salts, where a number of prints are immersed at once, nothing, as a rule, is better than a porcelain bath or dish, one with deep sides being preferable. If working $\frac{1}{4}$ -plate size prints the dish should not measure less than about 8 in. by 6 in., for it is needful, where several prints are in the bath at one time (which is the usual custom), to be constantly moving them from one side to the other. Hence the bath should measure rather more than twice the area of the sized print under manipulation. The dishes used for washing between toning and fixing should not be smaller than the above, nor should the hypo fixing-bath be any smaller.

Celluloid dishes have lately become very popular. They possess the advantages of not being readily broken if dropped, are light to carry, pack close, and, in small sizes, are cheaper than porcelain. Being made in five or six colours, such as yellow, orange, red, cream, etc., they are handy where one works with a large variety of solutions, inasmuch as one can at any time quickly identify a given dish, or set of dishes, by colour alone. Large sizes of celluloid dishes are slightly more expensive than porcelain, and are less able to stand ordinary wear and tear.

In some cases it is highly convenient, if not absolutely needful, to use glass dishes; these cost about half as much again as celluloid, viz., $\frac{1}{4}$ -plate, 9d., $\frac{1}{2}$ -plate, 1s. 3d. Plate-glass dishes with wooden sides are occasionally used where very expensive toning or sensitising solutions are employed, such as platinum; this because the surface of the glass being finer and the sheet much more truly flat than with any other material used for dishes, the dish, when accurately levelled, will enable one to float a sheet of paper upon an almost incredibly small volume of solution; thus with such a dish, one ounce of solution can be made to float a 12in. by 10in. print (Lyonel Clark). Papier mâché dishes are thick and durable, but have a tendency for the enamelled surface to crack. Ebonite ones (imitation) are light, durable, and clean, rather dearer than celluloid, and somewhat inclined to brittleness. Granitin and enamelled iron dishes are mainly used for platinotype, and for processes requiring heat, which none of the foregoing stand well except porcelain, and that only when it is gradually heated by immersion in water contained in a metal bath, warmed preferably by a Bunsen gas-burner or by a spirit-lamp. Where enlargements of considerable size are made, the question of the cost of dishes becomes a serious matter to those whose purses are not well stocked. Thus a 14in. by 12in. porcelain dish will cost from 4s. to 4s. 6d. Many expedients have been adopted to get over this difficulty.

Willesden Waterproof Paper, cardboard boxes waxed over, paint-enamelled wooden trays, glass-bottomed trays with wooden sides set in rubber cement, and similar devices are used. (Those who wish for further information should see my articles commencing on page 4, Vol. XIII. of the *Amateur Photographer*.)

For rinsing purposes, a paint-enamelled tea-tray having a depth of $\frac{1}{4}$ in. to $\frac{1}{2}$ in. is cheap, and forms a good makeshift; it can also be used for holding weak acidulated solutions for ferrous oxalate or platinotype procedures, and also for the alum bath in carbon work.

Printing - Frames.—These are devices whereby the negative is held in close contact with the printing surface of the paper, or other fabric, during exposure to light. Most of

them have contrivances enabling one to examine a portion of the print from time to time in order to judge when exposure is sufficient.

Fig. 1 shows the most ordinary form. The negative (N) is represented in position, film side up; one half of the back, and with it the paper in course of being printed, is turned back (B 1), the other half of the back (B 2) being held in close contact with the negative by the pressure-spring (S); this usually ensures that on turning down the half of the back (B 1) after inspection, the paper and negative come together with exactly the same register as at first. A reasonable amount of care, however, needs to be given to the handling of the above. The pressure-springs, if too

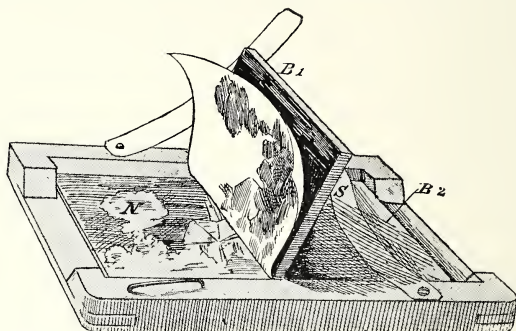


FIG. 1.

strong, are likely to break the negative, particularly if, as is not infrequently the case, the frame has slightly warped. If they are too loose, the print is apt to shift whenever it is examined, as before described. The best way to avoid this risk is to place the frame upon a flat surface, and, whilst pressing with one hand upon the back of it (Fig. 2), with the other to slowly unhitch one of the springs and cautiously turn it aside, thereby enabling the hinged back to be opened. Having examined the print, the action is reversed, observing the same precautions.

In order to lessen the risk of a print moving during examination, Mr. W. Tylar, of Birmingham, has recently

brought out an ingenious little frame (Fig. 3), which, besides other good points, has pressure-springs that do not slide on and off, but fold over and catch with much ease and no likelihood of causing the print to shift. The price is about the same as a fair quality article of the ordinary make. There are a variety of more complicated and expensive patterns designed to ensure good prints, such as those having backs which are hinged at a short distance from each end, the centre portion being always firmly held until the print is

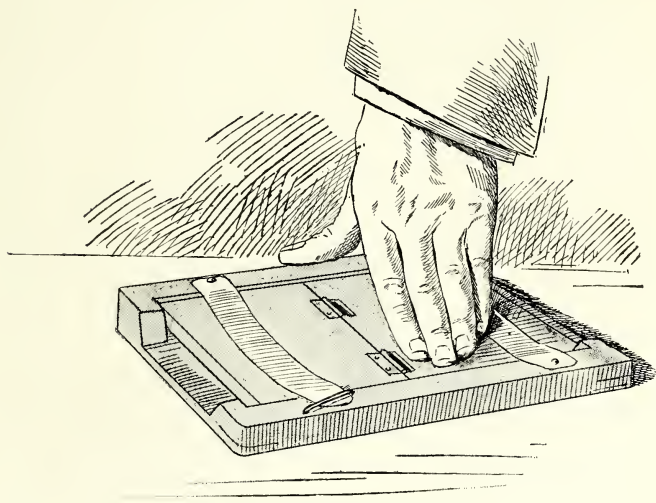


FIG. 2.

fully exposed. With large prints some such a frame is well worth its extra cost.

Where unusually large negatives are being printed from, it is always advisable to use a printing-frame which will hold a sheet of thin clear plate-glass for the negative to rest upon, and to have a well-padded back held in position by several springs. Again, in combination printing, where two or more negatives are successively printed from on to one sheet of paper, and particularly when that paper is not of the

print-out kind, some means whereby correct register may be ensured, is needful. For this purpose printing-frames are procurable which work upon a system of fixed pins; these hold the paper in position, so that when, in order to replace one negative by another, the print is moved, it can be subsequently returned to the position it formerly occupied in the frame.

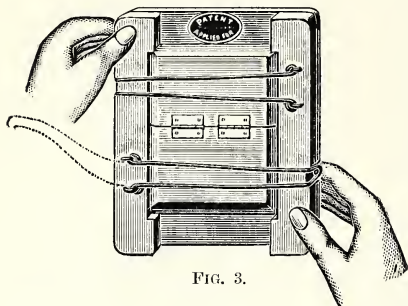


FIG. 3.

Printing-frames especially suitable to lantern-slide making are also obtainable. As a rule, for contact slides

(sometimes called dia-positives), an ordinary $\frac{1}{4}$ -plate printing-frame is used, and it serves very well; but in order to facilitate the production of correct perpendicular and horizontal lines, and to enable a particular portion of a negative to be printed from, various contrivances are made. The Primus pattern, which permits of the making of a lantern-slide from any part of a negative up to whole-plate, is well worth its price—one shilling.

Films may be printed from with any of the ordinary frames providing that a sheet of glass is used upon which to support them, and to ensure complete contact between them and the paper; but where a rollable film is to be used which has not been made pliant by means of glycerine or other treatment, it will be needful to carefully fasten it to the supporting glass by two of its sides.

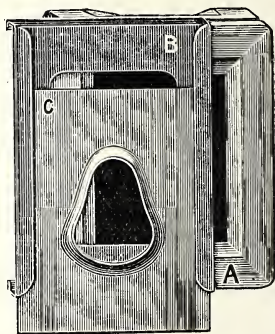


FIG. 4.

For exposing print-out opals and print-out lantern-slides,

special frames are made by makers of the above materials, so that one may from time to time examine the whole face of the opal, or of the glass slide, and replace it in register.

Vignettters and Masks.—Vignetting is not so much in fashion as formerly; nevertheless admirable results are obtainable by an intelligent softening off of the margins of a picture, as witness many of Emile Frechon's exhibited works. For portraits it can never entirely go out of fashion.

Vignettters are now procurable in quite a bewildering number of patterns and makes. Stained-glass ones have been longest in use, and are well approved. Very convenient, and cheap, too, are similarly shaded vignettters made out of thin celluloid or like material; the main objection to these is their liability to tear. The chief drawback to all of the above is that usually they will not cut off just those portions, and no more, of what is required. To overcome this an ingenious contrivance (Fig. 4) has been per-

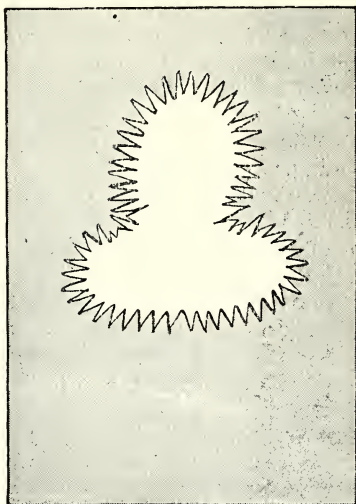


FIG. 5.

fected by Mr. Tylar, of Birmingham. It consists of a carrier (B) which slides across the front of a printing-frame (A); the carrier holds a zinc sheet (C) in which is cut an oval or a pear-shaped opening; this sheet slides at right angles to the direction in which the carrier moves, hence the opening may be accurately adjusted to any portion of a negative. The edge of the opening being raised about $\frac{1}{4}$ in., an unusually soft vignetting ensues. The above is sent out with a set of four vignettters, and may also be conveniently

used with any specially made cardboard vignettters, as described below.

Perhaps best of all is the home-made vignetter (Fig. 5), consisting of a hole cut slightly smaller than the desired amount of negative to be printed. The opening is next serrated, which makes it slightly larger than it at first was; in printing the effect of diffused light is to still further enlarge the area of action.

In using a vignetter, it is necessary to employ diffused light; light proceeding directly from the sun or from any point, such as a lamp, will throw a clean-cut shadow of the edge of the above vignetter upon the negative. Some, nevertheless, print in direct sunlight, getting over the shadow difficulty by keeping the printing-frame constantly rotating by means of a bottle-jack, or some other suitable arrangement, and using tissue-paper over the vignetter's opening. This amounts to a mechanical diffusion of direct light. Another matter to bear in mind is that the vignetter must not be placed close up to the negative. Most amateurs aware of this rest the vignetter upon the wooden moulding of the printing-frame, which rises about $\frac{1}{2}$ in. above the level of the negative. This, however, is hardly far enough away; the distance should not be less than 1 in., and in some cases more than an inch would be well. A convenient expedient is to put the printing-frame into a box of the required size from which the lid and the bottom have been removed; into this the frame must be fixed so as not to shift, and so that the glass side of the negative is about 1 in. from the opening in the vignetter. Having carefully adjusted the vignetter, and not less carefully fixed it, place a sheet of tissue-paper or ground-glass over the opening, and expose the print to diffused light. A home-made vignetter may be constructed out of a "stale" negative plate thus: Upon clean glass paste a piece of opaque paper rather larger than the desired opening; place this at about $\frac{1}{2}$ in. distance from the face of a dry-plate and cover with tissue, expose to artificial light, keeping the light, or the plates, in motion to ensure a regular penumbra, develop, and fix.

Glass and Other Materials Used for Shading.—Allusion has already been made to ground-glass in con-

nection with its employment for diffusing light in vignetting ; it is also much used by some to cut down the piercing glare and power of an illuminant during contact-printing. Thus, in exposing bromide paper to artificial light many find that they get truer and finer prints by interposing ground-glass, the finer gradations in the shadows being thereby retained. So-called opal glass, as having a finer grain, is still more preferred by those who have tested the two.

Green glass is also employed to improve the printing quality of a negative, or in some cases to modify the colour of the resulting print. If the proportion of yellow, orange, and red which enter into the colour of a negative is large in comparison with the amount of blue and violet, the negative usually prints, in ordinary light, much better than seems possible by mere ocular inspection. On the other hand, a negative whose image is largely built up of blues and purples, such as a rodinal developed one, will give by ordinary light a much poorer print than might be expected. In the second case the opacities do not cut off as much actinic light as their visual density suggests. If, however, we entirely get rid of the blue and purple light, we so far heighten the effective influence of the relatively small proportion of red, orange, and yellow in the image. Now, although a green-coloured glass by no means entirely eliminates all the blue and purple, it very much cuts down the most aggressively actinic rays of the purple end of the spectrum, and hence materially helps to lend vigour to a negative which otherwise prints too thin. Even thin pyro-stained negatives, which are apt to be quite yellow enough, are helped by being printed behind glass that cuts off part of the purple and blue rays, for reasons which cannot here be dwelt upon. In some extreme cases a pale yellow glass is found to effect what is needful. The employment of green or blue glass has also a not inconsiderable effect upon the resulting tone to which a silver print is susceptible, as we shall later on find.

Actinometers.—These are instruments intended to measure the amount of chemically active light which is affecting a sensitised surface during exposure under a negative. Of actinometers there are several excellent

patterns to be obtained. Most of them depend upon the use of suitably sensitised paper, which darkens on exposure to light, it being assumed that the amount of darkening is an accurate and constant measure of the actinic power exerted by the light. That is to say, X amount of light in ten minutes would produce the same tint as 10 X light in one minute, or as $\frac{1}{10}$ X in 100 minutes. Although this is not quite accurate, it is sufficiently so to make most of the actinometers of decidedly practical use and value.

Thus we have the Johnson actinometer: this is a small metal box having a glass lid painted to match the tint which is assumed by albumenised silver paper after a short exposure to light. An opening is left in the painted glass against which part of a strip of silver paper is caused to press during exposure to light; if the light be good, in a short time the paper darkens to the colour painted upon the glass. This light action is called *one tint*. The strip of paper is pulled forward and a fresh surface exposed; when this is sufficiently darkened to match the standard colour, we get *two tints*, and so on. In use, suppose we are printing in carbon, we estimate that the proper exposure with a given negative is, say, = 5 tints. If on trial we find this is correct, we need not afterwards depend upon judgment, or on guess work; but, however dark or bright the light, all that is required is to expose our carbon paper under the negative until five bits of the actinometer paper have been successively darkened to the tint which is painted on the lid of the instrument.

Similar in principle is Sawyer's actinometer, on the lid of which are twelve numbered spaces, each space being graduated from a very faint opacity in orderly sequence until the last is exceedingly dense. On exposing a piece of sensitised paper under the above to light, in X minutes space 1 is sufficiently discoloured to enable its number (painted in opaque pigment) to be read; in Y minutes more, No. 2 becomes readable, and so on. Burton's actinometer is very similar to the last, but instead of an artificially produced series of opacities, a set of six, or more, diminutive negatives, arranged in order of density, is used. One of the

most recently introduced actinometers is Wynne's, which is available not only for judging contact-printing by daylight, but for any other occasion where the actinic quality of light is required to be tested. Daylight enlargement and lantern-slide making by reduction are two out of many occasions when such an actinometer as Wynne's is particularly useful. The meter in question, known as the "Infallible," is not unlike Sawyer's, except that instead of twelve it has thirty-two degrees of density. The action of Wynne's printing meter depends upon the principle that the intensity of light

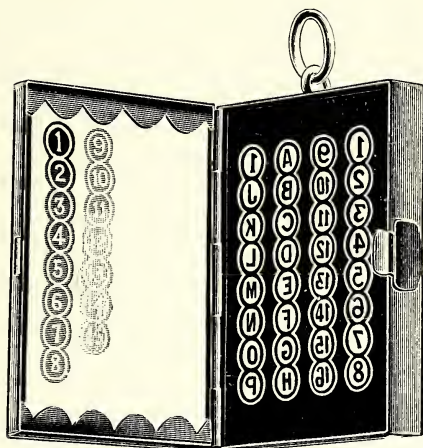


FIG. 6.

is directly as the sizes of the apertures through which it passes in order to act upon the silver paper of the actinometer. This is virtually the same principle as was used in Spurge's sensitometer.

Fig. 6 will give the reader a clear notion of the appearance and method of using Wynne's Infallible Print Meter. The criterion of actinic action adopted is the number which can be read off after the required amount of exposure has been given. In the illustration 15 is the number in question.

Home-made actinometers may very well be employed to gauge the otherwise uncertain action of daylight in printing. Various devices may be availed of; thus a piece of glass, say $\frac{1}{4}$ -plate in size, is ruled off into twenty squares, which are numbered with opaque paint, 1 to 20; over square 1 is placed a single thickness of tissue-paper, over square 2 two thicknesses, and so on until the last square has twenty thicknesses of paper. Any convenient print-out paper is used with the above.

For platinotype printing, Captain Abney recommends the following: A piece of platinotype paper is divided into twenty spaces, these are exposed to diffused daylight in the ratios, A, 1; B, $1\frac{1}{2}$; C, 2; D, 3, etc.; thus C has twice the exposure of A, and so on throughout the series. The paper being developed, the spaces are marked A, B, C, etc.

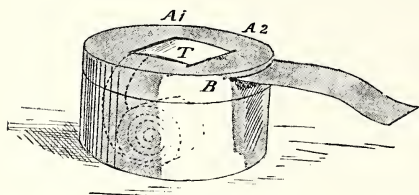


FIG. 7.

The exposure should be so timed that A, when developed, shows a very faint tint, and the longest exposed a fully intense darkness. The above is used as follows: A strip of platinotype is exposed

under the above, alongside the trial print; when this is removed for development, the last letter to become visible (without development) is noted. If the print which has been exposed comes up right in the bath, any number may be subsequently correctly exposed without examination, by referring to the actinometer. On the other hand, should the print prove to be rather over- than under-done, the actinometer will be a sure guide to definitely reducing or increasing the exposure of the print to follow. This plan may be adopted for other kinds of printing paper. A very easily home-made actinometer, costing practically nothing, may be made as follows:—Get a cardboard ointment box of about $1\frac{1}{2}$ in. in diameter, cut two parallel slits in the lid at A 1, A 2 (Fig. 7), about $\frac{1}{2}$ in. in width and the same distance apart. At B cut another slit of the same width.

Expose a piece of gelatino-chloride (or any other print-out paper preferred) to light until it assumes a pale tint. Now, using water-colours, paint the lid of the box to match the tinted paper, both in tint and in depth of colour. This done, take a strip of the gelatino-chloride paper about $\frac{1}{2}$ in. wide, roll it up, pass the free end through the slit at A 1 and A 2 in the lid of the box and bring the end out at B. Place the lid on the box, and enclose the roll of paper. The actinometer is then complete. As soon as the paper at T is tinted to match the top of the box, we get *one tint*; the free end of the paper is then pulled through so that a fresh surface becomes exposed to the action of light.

Many people gauge the actinic action upon invisible images by employing print-out paper exposed under a negative of similar quality to the same light as is acting upon the invisible image upon the non-print-out paper. Thus, if it is known that a given brand of gelatino-chloride prints about as quickly as a given make of carbon paper, sheets of both kinds are exposed under negatives of similar quality; when the P. O. P. looks finished, you will know that the image upon the carbon, although perfectly invisible, is fully—but not too fully—impressed. If the P. O. P. is only three-quarters as fast as the carbon print, expose until you get a “pretty” impression—one which would not be full enough for toning—then take the carbon from its frame, leaving the P. O. P. to finish by itself. If the carbon is, say, twice as slow as the P. O. P., then print off two prints of the latter while one of the former is being exposed. The advantage of this is that once the correct ratio of sensitiveness between the two above, or any other papers, has been found, one can almost with assured certainty, by means of pairs of negatives, knock off a correctly exposed print *at the first attempt*.

Whatever pattern of actinometer is used, it must always be remembered that there is a liability to the sensitised material to “slow down” in its rate of action, due to the want of keeping property in all such preparations. Another point to bear in mind is that the ratio between different kinds of paper varies with the time of day and period of the year.

Thus, whilst the sun is between 90deg. and 30deg. above the horizon, silver paper and platinotype paper might be equally rapid; but let the sun be under 15deg. from the horizon and it will be found that platinotype is considerably quicker printing than is silver paper. Wherefore in winter, near eventide, or in gloomy weather, silver paper is relatively much slower than platinotype.

It may seem to some that I have given an unduly large amount of space to actinometers; but I feel that in many cases prints are more or less injured by examination during printing—degradations of high lights, marking of the paper, admission of damp, and above all, the unnoticed shifting which follows the continued turning back of the paper, have between them to answer for considerable loss of quality. Therefore, even where one is printing on print-out paper, the use of a meter will be often found desirable. In printing from, say, 12in. by 10in. negatives, the risk of damage to print and negative is considerable, and is well worth avoiding, by timing the printing by means of a $\frac{1}{4}$ -plate negative as suggested, or, better still, by using an actinometer such as Wynne's.

Sources of Light for Printing.—Foremost, of course, is sunlight. This is rarely used direct and of full intensity, but either diffused by clouds or else by printing in the shade. None the less, with unusually hard or dense negatives, printing in direct sunshine is sometimes availed of with the greatest advantage. The direct rays of the sun are also occasionally employed for enlarging by means of the solar camera. Sunlight, although the most powerful, is by far the most inconstant of all illuminants. The actinic intensity varies from month to month, and day to day; this variation is, of course, still more marked from hour to hour. The usual brilliancy of sunlight is not always a reliable test of its printing capacity. The whiter or bluer the light, the quicker it will print; as the light gets yellower, it becomes slower. Often cloudy weather, without direct sunshine, prints quicker than a blaze of golden sun-rays, such as we may get in the last two hours of the day.

DIFFUSED DAYLIGHT.—For all ordinary print-out purposes with fairly good negatives, nothing is better than a diffused daylight, which permits one to lay the printing-frames face upwards where plenty of quick-acting light may fall upon them.

ELECTRIC LIGHT.—Next to daylight, this is, perhaps, destined to be the most serviceable. For bromide contact-printing it is one of the most satisfactory illuminants obtainable. For this purpose an incandescent lamp, as used in the Friese-Green automatic printing-machine, is best. For print-out papers and platinotype the arc lamps have been found convenient; they are still more useful for enlarging purposes.

LIME-LIGHT, considering its intensity, is less often used in photographic printing than one would think would be the case; this is no doubt due to the trouble and care involved in using the light, and to its inconstant intensity.

MAGNESIUM IN OXYGEN is another form of actinic radiant energy which is rather unaccountably neglected. The light in question was introduced to the Photographic World by means of a lamp devised by Mr. Humphreys. A comparatively short exposure to the above lamp was found to be sufficient to print platinotype or gelatino-chloride paper through an average negative.

MAGNESIUM RIBBON.—This is perhaps the most popular of all artificial illuminants with the ordinary amateur, being especially useful for bromide prints, lantern-slides, and other dia-positives. It is cheap, requires nothing special to burn it in, and no skill to use it. Allied to it is magnesium powder, which is, however, used for obtaining negatives rather than for printing. Magnesium ribbon is occasionally employed for enlarging with not inconsiderable success.

INCANDESCENT GAS-LIGHT is utilised for much the same purpose as magnesium ribbon. Of late it has become very popular for use in enlarging lanterns, for which purpose it has many good points and but few faults.

ACETYLENE is an illuminant of quite recent introduction. It cannot at present be said to have established itself as a source of light for photo-printing. Its drawbacks are

its unpleasant smell and its prejudicial effect upon the minds of insurance officials. It is, however, tolerably safe, providing that a good quality of carbide and a good type of generator be used.

ORDINARY GAS.—Regarding this very little need be said, except that it is apt to vary according to the pressure and quality of the gas, and to the make and condition of the burner. It is mainly used for transparency work, opals, bromide paper contact prints, etc.

OIL LAMPS AND CANDLES.—Besides the last-named illuminant a good word may be said on behalf of oil lamps, which, properly trimmed, give a tolerably constant light; and wax candles, which also vary but little. Even a match or a vesta may, on occasion, be used for photographic printing, as with $\frac{1}{4}$ -plate bromide prints, or lantern-plates.

Sources of Heat.—Heat, or temperature, plays a not unimportant part in all photo-printing processes, and in some is a *sine qua non*. All chemical action is rendered more energetic by an increase of the temperature, and *vice versa*. Hence, if an ordinary toning-bath, such as is used for gelatino-chloride paper, is below, say, 45deg., it is so inactive that toning is hardly possible. Increasing the temperature to 65deg. at once hastens the action of the bath. If, however, the temperature be much raised, in some cases the constituents of the bath re-act on one another, forming compounds inimical to the well-being of the print. A high temperature is also injurious to such papers as are prepared with gelatine which has not been rendered insoluble by means of formalin or some such hardening agent.

The Bunsen burner or gas fire is a device whereby a mixture of gas with air is formed, the mixture being then burnt by the aid of the air which comes in contact with the flame. It should give a blue light, free from unconsumed carbon; if the light is yellow, or whitish, and a black deposit forms upon anything put into the flame, the latter has caught back, and is not properly burning.

A spirit-lamp is often of use, and needs no description.

What is termed a *bain-marie*, or water-bath, demands

a few words. It consists of an arrangement whereby a porcelain or other vessel is stood in hot water, contained in a larger metal vessel, which is warmed by any convenient source of heat. In developing or toning platinotypes, or in toning bromide papers, such an arrangement is most convenient. The same arrangement is often useful in hot weather in order to keep the solutions cold; in this case the outer dish is partly filled with ice and water, or with any other heat-absorbing mixture.

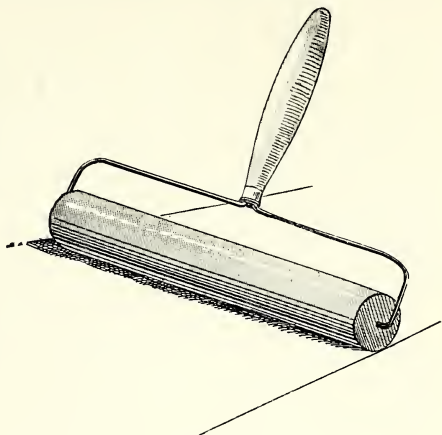


FIG. 8.

Various Useful Articles.—A chemical thermometer is always desirable, and in some cases indispensable. It consists of the usual glass tube containing mercury, having the degrees of heat marked inside the glass; hence the whole can be immersed in hot solutions and the tube can

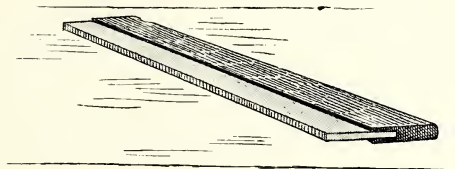


FIG. 9.

be kept absolutely clean. As a rule, the whole thermometer should be put right into the solution and left there for a minute or more; when done with, the thermometer should be carefully and completely rinsed and freed from any of the chemical in which it has been placed.

Squeegeeing surfaces are amongst other minor printing

necessaries. Of the glazed surfaces, glass is the most popular, as being generally available; next in favour is celluloid. For matting prints ground-glass is most used; while ferrotype sheets are also in favour.

Some people have trouble through prints sticking to glass; for these, Tyler's Pulp Slab, which does not require a preliminary preparation with French chalk, is convenient and inexpensive.

Squeegees are used for ensuring perfect contact between two flat surfaces. The two principal forms are shown at Figs. 8 and 9. The former is a roller of rubber, preferably solid rubber, while the latter consists of a piece of rubber let into a wooden frame. The latter form is more generally useful.

CHAPTER III.

PREPARING THE NEGATIVE FOR PRINTING.

THE subject of this chapter is in itself sufficient for a book, but, although slightly outside printing processes, inasmuch as these last cannot be properly carried out unless some preliminary attention is given to obtaining in a negative that particular quality which best accords with the end in view, a few leading particulars are briefly given.

Clearing.—Much benefit often accrues to the printing quality of “pyro” negatives, and sometimes to other kinds, by passing them through a clearing bath. By so doing, even if no other improvement follows, the time of exposure is much reduced. The following is as good as any:—

Alum...	...	...	...	...	...	1oz.
Sulphuric acid	...	...	...	...	...	$\frac{1}{4}$ oz.
Sulphate of iron	...	...	...	...	...	3oz.
Water	...	...	...	...	...	1 pint.

Reduction.—A considerable proportion of negatives will usually be found to be troubled by a thin film of opacity spread over the whole of the surface; this may be due to over-exposure; to reflected light in the camera; to the dark-room lamp slightly fogging the plate during development, etc.; or to chemical fog, produced by over-prolonged development, or by over-doses of soda, ammonia, or other alkali. The immediate effect of this is to prevent the deepest shadows of the negative, which theoretically should be “clear glass,” from printing with that full strength that one would like. In other words, the shadows are “veiled.” In such a case, soak the negative in water

until the film is quite soft, and then immerse in sufficient of the following :—

Hypsulphite of soda ...	...	...	...	1oz.
Water ...	...	...	...	1 pint.

The above should be a white transparent liquid. Having poured out enough to well cover the negative, add, just before use, as many drops of a 10 per cent. solution of ferricyanide of potassium as will make the mixture a pale greenish amber. Watch that the reduction is not overdone; if the negative is left long in the mixture, the image may entirely disappear.

Intensification.—Sometimes, either from the effect of the reducing solution, or through errors of exposure or of development, negatives lack strength in the high lights; the cure for this is intensification. Out of many formulæ the most popular one is appended. First *thoroughly* eliminate all hypo from the negative; this done, put it straight from the washing water into an acidified solution of mercury. Thus, to a saturated solution of mercuric chloride 10oz. add hydrochloric acid 15 minims (or drops). A weak negative should be very thoroughly bleached by the above; a less weak negative will need less bleaching.

Thoroughly wash, and immerse in a 10 per cent. solution of ammonia, leaving it in the above until the whole of the mercury is completely darkened. If still more intensity is needed, the above treatment can be repeated. Instead of using ammonia, the bleached plate may be redeveloped in a pyro, or, better still, in an acidified ferrous oxalate developer; but the latter requires some care in use, the details of which cannot be here dwelt upon.

Local Reduction is frequently much called for, particularly when, as often happens, halation is present. For this purpose spirits of wine rubbed on by means of any soft material; or levigated (finely powdered) chalk moistened with the foregoing, and rubbed over the part to be reduced, will be found very efficacious. At the same time, while with some subjects the improvement is wonderful, with others much harm ensues.

Staining.—Somewhat analogous to the use of tinted glass.

is the practice of staining the negative, for which purpose it is immersed in any convenient solution of transparent yellow dye or other tinted pigment.

Akin to plain staining is the action of the uranium intensifier. For a $\frac{1}{4}$ -plate take 2oz. of a solution of uranium nitrate (4gr. to each ounce of water), in which soak the plate; pour the solution into a measuring-glass, and add three or four drops of a 10 per cent. solution of ferricyanide of potassium. If needful, add more of the last named, rinse in slightly acidulated water, dip in plain water, and dry. Do not overdo the above; the uranium soon makes the whole film non-actinic, and correspondingly tedious to print from. The whole stain can, however, be quickly removed by placing the negative in weak ammonia and water; or small parts may be similarly relieved of the uranium, by carefully touching or painting with the last-named, or with some other alkaline solution.

Varnishing.—This is called for, for two reasons: first, for the protection of the film from abrasion, damp, and the injurious action of various chemicals present on the surface of sensitised paper; secondly, in order to enable retouching to be carried out. If varnish is to be applied, see that all has been first done in the way of intensification, reduction, etc., that is needful.

Varnish may be applied to a hot plate in the ordinary way, or to a cold plate, which is a less common method. To apply "hot" varnish is none too easy. First, the plate is heated until it is "pleasantly" warm to the back of the hand; next, the varnish is poured on to the plate, much as is done when coating a plate with collodion, and is similarly flowed over the film. That is to say, the plate being held level, a pool of varnish is poured where the dark spot is marked (Fig. 10); this spreads as indicated by the shaded part; the plate is then slightly and successively inclined towards A, B, C, and D, so that the varnish travelling in the directions indicated by the arrows, spreads evenly over the plate. The surplus is poured off into a wide-mouthed bottle, the plate being the while rocked to prevent the formation of lines or markings. To prevent the varnish from running down the back of the negative when it

is draining off into the bottle, with a cloth run down the two bottom inclined edges towards the bottle. This also takes away the excess of varnish, which otherwise is apt to form little ridges around the edges of the plate. Most amateurs fail to acquire the needful dexterity to properly perform the above. For such, nothing is perhaps better than Mawson's Cold Varnish; with this all that is needful is to soak the negative in some of the solution and dry it off as if it had been taken direct from the washing water; or the varnish may be painted on. This varnish is also very useful for *films*.

Ground-glass varnish is applied to the *glass* side of the nega-

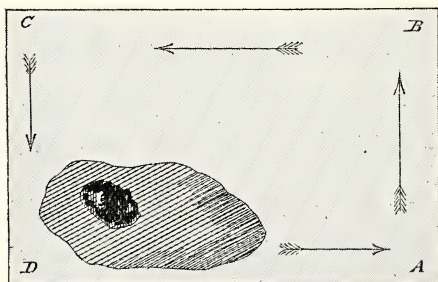


FIG. 10.

tive where modification of effect is called for. It is put on much as described for hot varnish. Parts of it may be wiped off with methylated spirit, or erased with a knife; other parts may be darkened with charcoal, chalk, etc.

Instead of this varnish many prefer to use tissue-paper, or *papier mineral*, pasted on to the glass side of the negative. To do this, neatly stretch the paper upon a light frame so laid down that the paper rests upon a smooth, flat support, apply a thin and even coat of any convenient adhesive to the glass, and press the glass in contact with the paper. The printing densities of fairly large negatives are with much facility altered by working on the paper with brush, lead-pencil, pen, and scraper, washes of yellow or blue colour being applied as required, and, especially where large figure studies are in consideration, acceptable effects are quickly obtainable by using stumps and powdered chalk or charcoal. As regards working with pencil upon the face of the negative, little can be said.

Spotting must, of course, if needful, be done ; it is, however, a somewhat difficult operation to do well. Colour as nearly as possible of similar opacity and tint to that of the negative should be used ; it should be mixed to a thick consistency, and applied with a small, finely-pointed sable brush. The spot to which the colour has to be applied should be made rather *darker* than *lighter* than the surrounding tone ; so that in the print the spots appear *slightly* lighter than they should. This is, as a rule, easily put right by re-spotting ; but a darker patch on a print cannot so well be painted out, except with much trouble and skill. If the place to be spotted be a pit, *i.e.*, clean glass surrounded by a crater wall of gelatine, the pit must be filled up with gum arabic, and the latter dried before spotting is attempted. As regards what is known as re-touching, 99 per cent. of amateurs had better have nothing to do with it. The 1 per cent. left, and the general run of professionals, are advised to receive instruction at the hands of an experienced re-toucher, mere written description of the procedure being of little use. In any case the present manual cannot spare space for the information.

CHAPTER IV.

PRINT-OUT PAPERS.

Gelatino-Chloride Paper.—In dealing with print-out papers, which although not entirely, are mainly, what are called “silver papers,” one has been taken as embodying all the main procedures and manipulations common to this class of printing and toning. The present chapter will therefore deal, in some detail, with the practice to follow in making prints upon gelatino-chloride paper; whilst succeeding chapters will touch upon the particular modifications called for in working other kinds of print-out silver paper, such as albumenised and collodionised.

At the outset I wish to say that the selection of gelatino-chloride as a type does not imply my preference for the make of paper in question over other kinds of silver paper. On the contrary, for several reasons, which are stated in their proper places, gelatino-chloride paper, as at present procurable, is less esteemed than are certain other silver papers, of which the most notable is collodio-chloride. But the object of this little work being to explain the way to work popular printing processes, it would have been ill-advised to give a back seat to what is certainly at the present moment the most popular of all print-out papers.

First, what is a print-out paper? A print-out paper is one which on exposure under a negative to light is impressed with a visible image showing the full detail of the finished print.

Partly print-out papers are those in which only a faint, or imperfect, image can be seen after exposure to light, *e.g.*, platinotype.

Papers which do not print out are those in which no visible image of a negative is produced by light, but is developed up; as, for instance, are the latent images of negatives. Of this class bromide paper is the most characteristic example. The above are three broad and convenient classifications; at the same time the demarcating lines between the three are somewhat arbitrary ones, and papers are placed in one category or the other with which they do not in all cases fully accord. Thus, although gelatino-chloride paper, often called P. O. P., nearly always justifies its name, it may nevertheless be treated as a partly print-out paper, and be developed up by a suitable reducer.

Again, certain papers which are grouped with those which have no visible image until developed up, none the less show some signs of light action, particularly when examined by transmitted light. Bearing the above qualifications in mind, the instructions and descriptions which follow will be, as far as possible, given under the three main headings, print-out, partly print-out, and non-print-out papers.

Gelatino-chloride Papers (also called P. O. P., Solio, Sylvio, and many other fancy names).—First, of what does the paper, or rather its sensitised surface, consist? Essentially the sensitised matter with which the gelatino-chloride paper is usually coated consists of a citro-chloride formed into an emulsion with silver nitrate and gelatine, although other organic salts may, in some cases, be substituted for the foregoing. There are many makes of this paper on the market which, although they have a generic similarity, possess more or less marked differences, though these are too numerous, and sometimes too trifling, to dwell upon. One unfavourable thing, however, as far as I know, common to all the gelatine papers, is the acidified condition of the film; this is made so in order that the sensitiveness of the emulsion may remain unimpaired for some time, and because *the addition of an acid facilitates the coating of the paper*, and also prevents the free silver nitrate from attacking the gelatine. If no acid were present, red stains would be formed similar to those caused

on gelatine dry-plate films after long printing with albumenised paper. This acid state is, under suitable circumstances, liable to set up a condition of decomposition of part of the gelatine, which is then apt to form various obscure combinations with the silver salt held in the emulsion. Moreover, it calls for the addition of a considerable amount of alkali to the toning-bath, which is not a gain to the toning.

Despite all its faults, and it possesses a few, gelatino-chloride paper has almost entirely supplanted the erstwhile favourite albumenised silver paper which ten years ago was practically the only printing process in use. The reasons for this are not far to seek. First, gelatino-chloride paper prints quicker; next it gives a finer detail, and will take a higher glaze. Moreover it gives better prints from thin negatives; this last quality is often worth a good deal, for the evolution of the manufacture of the dry-plate, and of the habit of development, are both in the direction of a thin, rather than of the old-fashioned plucky negative. A thin negative is more quickly made, alike as regards exposure and development, and prints ever so much quicker; hence one reason why gelatino-chloride has been so much favoured.

As regards the chief drawbacks of the paper, much might be said; enough that amongst its most frequent or serious defects are (1) a tendency to give double tones, *i.e.*, warm shadows, with bluish high lights and half-tones; (2) unpleasing tones; (3) yellow high lights; (4) hard prints from plucky negatives; (5) want of permanency.

As regards (1) many explanations have been offered. The fundamental cause seems to be due to the physical condition of the gelatine film, the under parts of which on immersion in water become difficult of access to the washing water, which should remove the toning solution; hence partial if not complete over-toning may ensue.

Again, the light half-shadows lying mostly upon the surface of the gelatine are soonest reached by the toning agent, whence toning not only begins, but is finished, before the fluid employed in the toning has permeated far enough to reach the deeper lying parts of the image which compose

the dark shadows. It follows that, in order to tone the latter, the treatment is so prolonged that the half-lights become grossly over-toned, with the usual result of an unpleasant flat and cold appearance. A contributory cause to bringing about double tones is an inactive toning-bath, due to acidity, or to lack of gold, or to other reasons.

(2) Unpleasing tones are mainly due to the character of the toning-bath, the extent of the toning, the character of the negative, and the quality of the light used for printing; they may be said to be within the photographer's control.

(3) Yellow high lights are induced by stale paper, by an excess of sulphocyanide in the toning-bath, and by sulphurisation during toning and fixing, which last is the usual result of using the combined bath. (4) A hard print from a strong negative is perhaps less a fault than a characteristic. (5) The lack of stability in the finished print is a very variable quality, depending on the manufacture of the paper, which, as a rule, the printer is quite unable to gauge or test; next it depends upon the age and manner in which the paper has been stored; and finally upon the treatment it has been subjected to in toning and fixing. The various operations need to be carefully and efficiently carried out. A stable and non-acid bath should be used, two fixing-baths employed, and the washing should be ample without being excessive. Such are the main conditions of reasonable stability; it may be assumed that all the conditions are not usually present, and hence few gelatino-chloride prints keep long in good condition.

Printing.—Although gelatino-chloride paper, as commercially made, will keep in fairly good condition for a considerable time if care in storage is taken, the best and most lasting results are obtained where freshly made paper is used. Stale paper is apt to be somewhat degraded in the high lights, especially if the packet has been opened. Some deterioration may also be put down to the acid preservative acting upon the gelatine, which, in its turn, re-acts detrimentally upon the silver chloride.

In any case where hours or days elapse between the opening of a packet or a roll of paper and the toning, the

paper should be kept not only light-tight, but air-tight; to which end it is well to store it under moderate pressure. For this purpose are procurable storage boxes having a spring that causes a sheet of wood, or other material, to press upon the contained paper. A copying-press, or even a pile of books, will do better than nothing; while very convenient and efficacious is an ordinary printing-frame, in which a piece of glass is first placed, then a light-proof paper, next the sensitised paper, while another sheet of glass is interposed between the paper and the hinged back.

The above remarks and expedients apply to most of the papers in use for photographic printing. As regards actual exposure to printing light under the negative, there is not much which applies more to gelatino-chloride than to other print-out silver papers. Keep the paper dry; the best and cheapest means is to cut up india-rubber sheeting into pieces the size of the plate. Print in a diffused light, unless the negative is unusually plucky, *i.e.*, full of contrast and sparkle, in which case printing in direct sunlight may be called for; sometimes a happy medium is found by exposing to bright direct sunshine with thin tissue-paper interposed. In the case of a weak negative, ground-glass, green glass, or even pale yellow glass may be profitably used, the printing being done in the shade (diffused light). By such an expedient a considerable improvement in the light and shadow of a print may ensue. But with silver printing nothing will make an over-poor but printable negative rival the rich and attractive tones which result from a negative of suitable quality. With this as with all other print-out papers, the printing-in of a supplementary sky is tolerably easy, as is also what is called combination printing; *e.g.*, printing one or more figures from one negative into, say, a landscape from another negative, and, similarly, combining parts of any two or more negatives. Sunning-down is also a very simple matter; these and such like are, however, technical details dwelt upon elsewhere.

One last point. Before toning some experience is required in order to judge when the printing has been carried far enough. In nearly every case as regards a beginner, the

cardinal mistake made is to under-print, hence follow weak, wishy-washy results. It must be borne in mind that the preliminary washing very considerably reduces the strength of the image; after toning there is also a further slight loss in the fixing-bath, the amount of which varies greatly under different circumstances. When, therefore, the photographer, upon examining his print, finds that it looks about what he would wish it to be when finished, he should leave it for a



FIG. 11.

considerable time longer in the printing-frame, say, if the time so far has been fifteen minutes let the exposure continue for another five minutes, or even ten minutes, depending upon the brand of paper, the class of negative, and the warmness of tone desired. This timing is merely approximate, and is meant to ensure that the beginner rather over than under prints. As a rule, the best way to judge is by inspection; the print should have its high lights (purest whites) slightly tinted.

As a guide to the amount of over-printing more or less called for by all print-out silver papers, four reproductions of a print, upon gelatino-chloride paper, from the same negative are reproduced. They represent "Eventide at Chilworth," and are by Mr. G. W. Jenkins. Fig. 11 shows the print before toning in the "pretty" stage. Fig. 12 shows the same after toning, printing, etc.—note its under-done appearance. Fig. 13 shows a print properly exposed for toning—note its over-done appear-



FIG. 12.

ance. Fig. 14 shows the last after toning and fixing. Whilst on the subject of printing let me point out that with gelatino-chloride, as with most silver print-out papers, there is a maximum amount of exposure suitable for each particular tone desired, and that printing must therefore be regulated according to the amount and character of the toning which is to follow. On placing a print in the toning-bath the image is found to be of a warm, generally a reddish, hue ; as gold becomes deposited upon this reddish

image, it gradually turns, first brown, then black, next purple, finally bluish or slate-coloured.

The strongest or pluckiest tone is where there is a large proportion of gold backed by a proportionately small amount of silver. This combination lends a strong and pleasant colour, and the image is but little weakened by the subsequent fixing-bath. Hence in printing on gelatino-chloride paper with the sulphocyanide bath, if a full warm black is desired there need not be very great



FIG. 13.

over-exposure in the printing-frame. On the other hand, should one wish to get an unusually warm brown, considerable over-printing is called for, because, only a small proportion of gold being present in the finished print, most of the image is in silver, whence it follows that a large portion of its vigour gets reduced in the hypo. For a different reason, where an extremely cold black is aimed at, and the verge of over-toning is reached, over-printing is called for, as there will be found a distinct falling away

in strength of the image where the toning is pushed to its fullest extent.

Bearing the above in mind, one may often save a print, accidentally over-exposed, by either very slightly or, rather, excessively, toning it.

As already stated, the chief precautions to observe during exposure to light under the negative are to keep the paper dry, to prevent light from reaching the paper, except that which passes through the negative, and to

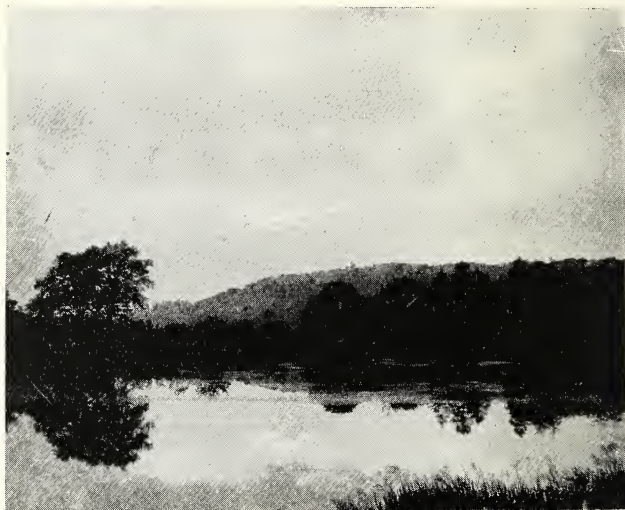


FIG. 14.

avoid a slight shifting of the paper, which sometimes happens during the examination of the print in order to see if it is sufficiently printed. The inexperienced are particularly likely to injure prints by needless and careless examination. Such are advised to gauge exposure by means of some simple meter. (*See Chapter II.*)

Prints when withdrawn from the printing-frame should be immediately placed with the face of one against the back of the next, in a receptacle which is light-tight, and

as far as possible air-tight. (*See* page 34.) The sooner toning is done after exposure, the better, though with some papers a considerable time may elapse—measured by weeks—without any appreciable harm ensuing.

Toning Preliminaries.—Before toning is proceeded with, see that the following materials are at hand and in order: three or four dishes—A for washing, B for toning, C for washing, D for fixing.

If but few prints are being done, washing may be accomplished by one dish; but where a large number are being toned, and the toning-bath is acting quickly, before all the prints, taken one by one out of A, are transferred to B, those first placed in the toning-bath B will be perhaps fully toned, and require to be transferred to C, the “stop,” or second washing-bath.

The toning solution should be ready, and tested for acidity. Note that while some toning-baths need mixing about twenty-four hours before use, others must be made up only as required. Means should be available for keeping the solutions at about 65deg. Fahr., and a thermometer for testing the temperature should be at hand. An abundance of water, soft if possible, is a great consideration; those who work where water is scarce and a running supply unavailable for washing, must adopt the system of filling a dish and, after a suitable interval, completely emptying it, and refilling until washing is complete. All dishes should be scrupulously clean, and especially free from minute remains of chemical solution used for other purposes; that is, unless the photographer's chemical knowledge enables him to positively decide that such are not harmful.

Washing Prints.—This is a more important operation than many people think. The object of washing is to get rid of the soluble silver salts which have not been affected by light during the printing. As soon as these salts are dissolved by the water, they are in a condition to combine with the gelatine surface of the paper, and with the paper itself, one result being that there follows a yellowing of the high lights. In order to guard against this damage, it

is well to, *as quickly as possible*, change the *first* washing water, as it is then that the greater part of the mischief is done. It is, perhaps, better still to begin by placing the print, face downwards, in a solution of common salt (chloride of sodium), about 2oz. to the pint; this will change the soluble silver salts into an insoluble silver chloride. Carbonate of soda may be substituted for the foregoing.

It is only right to say that some practitioners consider that using salt or soda as above injuriously affects the toning; although great regularity of toning is ensured, they allege that the resulting colour is colder and less pleasing than where no salt or soda has been used in the washing water. Personally, I have not noticed any great difference. Before toning, the paper should be thoroughly freed from the above; in any case, three or more changes of water are required after the first washing-bath. The temperature of the washing water is best about 60deg. Fahr.

The prints are now ready for the toning-bath, which should be about 65deg. Fahr., if anything rather more than less, but not over 75deg. Fahr., as the gelatine is injured by a higher temperature, or at any rate it becomes unduly soft, and the bath tones too quickly.

Toning.—The prints are taken one by one from the washing-dish and placed at one end of the toning-dish face downwards. When as many as can be safely attended to have been transferred (four are quite enough to begin with, although an expert can safely manipulate a great many more), the top print is turned over and placed at the end farthest from where the four were first placed; the second is then placed on the first, and so on until the bottom one is at the top. The dish should now be rocked for half a minute or so, and the prints again shifted; these proceedings are continued until the required tone is obtained. The average normal time for different baths and papers is from five to ten minutes; a weak bath will take longer, and a strong one shorter than the average. Temperature is also an important factor to bear in mind. (*See Chapter II.*)

When is a print sufficiently toned? This is a question that necessarily occurs to every beginner. Given an average negative and an ordinary gold toning-bath there are two conditions of the finished print which are usually to be avoided. (1) a feeble pinkish image; (2) a not less feeble bluish image. The former is a sign of under-toning, the latter of over-toning, or over-rapid toning. Sometimes instead of bluish tones a general greyness is noticeable, due to the same cause. It is, therefore, a matter of some importance to know when a print has received sufficient treatment in the gold solution. With gelatino-chloride papers it is certainly easiest for the generality of people to judge as to the amount and the evenness of toning by examining the print with transmitted light. In other words, hold the print up to the light and look through the paper at the image; if the latter has a plucky and genial appearance, if in strength and colour it has palpably gained since it was taken from the washing water, and is free from uneven patches, providing the time has been not much less than five minutes, remove the print to the "stop" bath. Anyhow the colour (usually red-brown) which the print had before toning should become a darker, fuller brown. Such are the general directions to bear in mind. But various modifications are suggested by experience, by the object in view, and also by variations in the manufacture of the paper. Generally it may be said the weaker the bath, or shorter the toning, the warmer the print, and *vice versa*. Wherefore with any particular bath a considerable range of control is possible; but it is to be remembered that in any case the character of the negative very greatly influences the result, which is further dependent upon the printing light.

The visible image in a gelatino-chloride paper is compounded of the change brought about in an organic silver salt and a chloride of silver; these two light sensitive compounds are differently affected by the spectrum. In ordinary daylight the organic salt is more affected, whilst the electric light would proportionally affect the chloride salt to a greater degree than the organic one. Hence it may be deduced that the quality of a negative as regards

colour and range of opacity, will have a determining influence upon the image to be worked up in the toning-bath.

Whatever may be the aim of an individual regarding colour of a resulting print, he should not forget that there is a certain moment after the print has been placed in the bath when the most harmonious and forcible toning effect is attained. By harmonious is meant *pro rata* reinforcement of the original printing appearance of the negative; and by forcible the full possibility of shade and light which the toning can produce. This moment is the one to try and gauge; if over-or under-toning for obtaining colour modifications be persisted in, be sure the results are attained by sacrificing some of the inherent quality and power of the process. Where a particular colour is sought for it is best, if possible, to obtain it by modifications in the constitution of the toning-bath.

Besides such sources of blemish as have been already alluded to, the operator should beware of prints sticking together, either in the preliminary washing or in the gold bath, undesirable patches being likely to ensue. Dirty, hot, and greasy fingers are also at times answerable for such unsightly markings.

That gelatine absorbs a large amount of water, and in consequence swells up considerably, has been already mentioned; from this it follows that an appreciable proportion of the toning solution is so closely surrounded by gelatinous matter that the molecules of water in the washing dish cannot readily reach it; hence toning will continue for some little while after the print has been removed from the gold solution.

To counteract some more or less over-toning which would ensue, one of two courses is usually adopted: the print is either taken from the toning-bath a little while before it is considered fully done, trusting to the continuing action to finish the toning; or else what is termed a "stop" bath is used, consisting of salt and water—1 to 10. In this it may remain for an hour, or more if necessary, and then be either placed direct into the fixing-bath (hypo) or, according to most practitioners, first rinsed in clean water.

Toning - baths for Gelatino-chloride Paper.—The most highly approved toning-bath by users of gelatino-chloride paper is the following :

Gold chloride	...	...	...	...	2gr.
Ammonium sulphocyanide	...	...	...	...	30gr.
Water	...	...	...	...	16oz.

The above may be considered a standard, but need not be religiously kept to. Used weaker, warmer tones ensue ; with more gold, blacker tones follow. Just this advice to those who mix their own bath (and if in doubt it is best to do so, for all chemists are not versed in the niceties of photographic dispensing): Keep the gold in solution ; a grain to the drachm of distilled water is a convenient proportion. Just before toning pour out 2gr. into 6oz. of water, add a *little* carbonate of soda to neutralise any acid present—and some is sure to be in the gold solution—about as much as will go on a threepenny piece will usually suffice. Have ready the sulphocyanide of ammonium dissolved in the rest of the water to make up to 16oz., pour it into the toning-dish, then *slowly add* the gold solution, stirring the while. This is because if there be during admixture a great excess of gold chloride the gold will become precipitated and the bath inert, which will no doubt account for many failures ; for if the sulphocyanide be poured into the gold chloride the toning power of the bath is almost utterly destroyed. The above bath is best mixed immediately before use ; if not at once used it should be shielded from light, which will otherwise deteriorate its action. Although a sulphocyanide bath, if reinforced with gold, may be used during several successive days' toning, it is best to mix up an entirely fresh one on every occasion.

As a rough guide, it may be considered that 3gr. of gold, = 6gr. gold chloride, will fully tone a sheet of paper—say thirty $\frac{1}{4}$ -plate prints. For warm tones, some papers work very kindly with the following bath :

Sodium acetate...	...	...	...	...	150gr.
Gold chloride	...	...	...	...	5gr.
Water	...	...	...	...	1 quart.

Tone to chestnut colour, which becomes somewhat cooler in fixing. The above bath should be mixed twenty-four

hours before use. It will keep and work for a long while, and may be reinforced from time to time by adding fresh gold.

Another favourite bath with some is the phosphate of soda bath.

Stock solution :

Phosphate of soda	...	...	...	...	100gr.
Water	...	...	...	...	1 quart.

Take 16oz., to which add 2gr. of gold chloride in solution ; use immediately, as the bath when made up does not keep. Some unusually charming pictures have been produced with this upon Sylvio paper, a brand of gelatino-chloride made by Wellington and Ward.

Platinum Toning.—Gelatino-chloride paper tones very easily in an acidified platinum bath, more especially the matt surface paper. A fully “plucky” negative should be rather more than usual over-printed. After washing take of the following stock solution :—

Chloro-platinite of potassium	...	...	60gr.
Distilled water up to	...	...	2oz.

Two drachms, added to 4oz. of water, to which add 5 minims or 6 minims, or drops, of nitric acid ; or preferably, 20gr. of citric acid in solution. As the above tones very rapidly, it is a convenient method to immerse prints one at a time. The prints, according to make of paper and quality of negative, will tone to various shades of black. Diluting the bath with four or five times as much water as above makes the tone warmer. Fixing is as usual, but between toning and the hypo bath immerse the print in a weakly alkaline solution in order to get rid of all acidity.

Combined Toning-and Fixing-bath. — Although not favouring a combined bath, the following is given for those who prefer its sweet simplicity. Print, as a rule, a good deal deeper than required in the finished print, and immerse, either after, or without washing, in the following : Dissolve 3oz. hyposulphite of soda in 14oz. water, next add 3dr. sulphocyanide of ammonium ; when dissolved, gradually add 7gr. chloride of gold. Thoroughly mix and

filter before use. This works better when about 10 per cent. of a previously used bath is added to the freshly made one. To in the first place start the toning action, where no old bath is available, put a few cuttings of the silver paper into the bath. The temperature should be a full 65deg. Fahr. Some people, who otherwise distrust the combined bath, use it as a supplementary one. Thus after partial toning in one of the ordinary baths, say the acetate one, the print, instead of being put into a plain fixing-bath, is given a quarter of an hour in the combined bath, the tone usually obtained being a juicy purple-black.

For particulars of the development of partly printed-out gelatino-chloride paper see the succeeding chapters dealing with the class of paper in question.

Fixing the Prints.—The fixing-bath consists of 3oz. of hyposulphite of soda to 1 pint (20oz.) of water. The dish used should be clean, and the hypo solution should not have been already used for fixing; it should also *not be acid*. The prints should be kept moving in the bath, to avoid the risk of imperfect fixation of patches of the paper; the time needful for fixation is from ten minutes to fifteen minutes. If the hypo bath be made up just before use, it will be at a very low temperature. Should this not be remedied, blistering may ensue.

There is little or no visible sign that fixation is complete, except a slight clearance of the lighter portions of the paper, which may be detected by holding the print up to the light and looking through it. The shadows should exhibit evenness of tone, otherwise it may be considered that fixation has been irregular and incomplete.

Some practitioners add a drachm of ammonia to the pint of the fixing-bath; this is said not only to neutralise any acidity which might otherwise be present, but also to hasten the fixing; it is also calculated to reduce the liability to blistering, and to aid in the subsequent washing. Although a single fixing-bath is all that ordinary practitioners employ, whenever permanency is particularly valued it is in the highest degree advisable to pass the print through a second fixing-bath, or at any rate to be sure that the fixing-bath is unexhausted. The compound

which threatens the life of the print is the double hyposulphite of silver and sodium; this is soluble in hypo and remains in the fixing-bath if the fixing be thorough. If, however, the fixing be scamped, some of this double compound will be left in the film, and, being insoluble in water, it will, as a necessary consequence, in time bring about the ruin of the print.

Washing after Fixing. — When the print leaves the fixing-bath it is saturated with hyposulphite of soda, which holds in solution some small amount of the double hyposulphite of silver and sodium. It should here be borne in mind that this soluble double salt is said to be rendered insoluble by light; wherefore fixing should not be carried on in anything beyond a weak light.

In order to get rid of all the traces of hypo, a very thorough washing is called for; for should the hypo not be eliminated it ultimately decomposes, sulphur compounds are formed, the shadows of the picture become faint, and the high lights turn yellow. Thorough washing does not, however, imply an excessive amount of either water or time.

It may be accepted as an axiom that the shorter the washing, providing the hypo salts are got rid of, the better. Unfortunately, writers of text-books, and makers of printing-papers, in their anxiety to ensure permanence, have grossly over-stated the time needful to wash out "hypo."

Remember prolonged soaking and friction are calculated to more or less impair (1) the image, (2) the paper, (3) the coating, whether gelatine, albumen, or otherwise; especially is long soaking injurious to gelatino-chloride prints, as it tends to remove the matter which is employed by the makers to harden the gelatine. This may be tested by the following experiment: wash one print for fifteen minutes, and another for five hours, then squeegee them both on to ferrotype. In due course the former will strip, unless it happen to be of an unusually soft make, while the latter will stick. I am assuming that no alum bath is in either instance used.

Gelatino-chloride prints may be completely washed in ten minutes, providing they are immersed in running water,

which is constantly changing and passing along the surface of the prints. Where running water is unavailable, the prints may be as completely as possible freed from "hypo" as follows. Soak the print in a dish of water for five minutes; transfer to another dish for five minutes; and finally to a third for a similar time. The prints should be kept moving in each bath. Where a number of prints are handled together, not less than 1oz. of water should be allowed for each $\frac{1}{4}$ -plate. Thus used, in suitable receptacles, 3 quarts of water would be enough to wash forty $\frac{1}{4}$ -plate prints. This economy in the volume of water needed will be much appreciated by those who live in districts where it is scarce.

Mr. Haddon explains that the silver and hypo salts are well able in five minutes to diffuse out into the water in which the print is being soaked. So much being granted, the volume of the water compared with that of the solutions to be washed out, is so great that one may easily estimate what an infinitesimal amount of the above salts will be left after the third soaking. Should the reader consider the foregoing too revolutionary, let him give the prints yet another five minutes in running water, or another five minutes soak in a dish.

(A full account of the experiments by Mr. Haddon upon which the above advice is based will be found in the *British Journal of Photography*, Vol. XLIII. p. 468.)

If any doubt exist as to the presence of hypo, the washing water may be tested as follows:—Take of potassium permanganate, 1 part; potassium carbonate, 10 parts; water, 1000 parts; the foregoing would be equivalent respectively to about 1gr., 10gr., and 2oz. The solution should be rose-coloured. Add a few drops of it to a pint of the washing water to be tested, the latter should then appear pale pink; if, however, hypo is present, the colour will be greenish.

The Alum Bath.—The surface of gelatino-chloride prints is apt to be very liable to injury, especially during the last washing, and in course of mounting. Moreover, with the ordinary treatment as regards washing, and with some makes of paper, it is impossible to strip the prints from

either glass or ferrotype sheets unless a hardening process is adopted; without such hardening the prints are apt to stick tightly on to the support and remain immovable. The most popular, probably because it is the cheapest, and the readiest available, hardening solution is the alum bath. It is not very important to be exact in mixing up this bath, but 2oz. of alum to 1 pint of water will be found a good standard proportion for use after fixing; mix with hot water, and use when cold. If, however, circumstances point to a necessity for hardening the film before fixing—a practice which I dislike—the bath should be much weaker, say, $\frac{1}{2}$ oz. alum to 1 pint of water. In either case a thorough elimination of the alum is called for. Should alum get into the hypo bath the two will act upon each other and sulphurisation of the prints be liable. Similarly any traces of hypo in a print will in time be attacked by traces of the alum bath which may be left in with a like result.

From the above it will be gathered that the alum bath is a troublesome addition to the ordinary toning routine. Wherefore, whenever circumstances allow, it is wiser to do without this. To which end do not *over-wash* the prints; do not use a stronger solution of sulphocyanide than is absolutely necessary, the chemical in question being a fruitful agent in softening the gelatine film; and use the solutions as cool as compatible with an active condition of the baths. Be sure your paper is not an unusually soft make; the various brands have their own peculiarities in this as in other respects. An active and busy member of the Croydon Camera Club, who turns out many hundreds of prints a month, and who prints upon such brands of paper as happen to be in excess in his shop, by following a similar procedure to that above sketched, entirely dispenses with the alum bath, and has no trouble in squeegeeing either on to smooth or on matt surfaces.

Another film-hardener has lately been suggested, consisting of :

Aluminium chloride	...	...	...	...	1 part
Water	...	...	...	...	100 parts

($\frac{1}{2}$ oz. by weight of the chloride to $2\frac{1}{2}$ pints water). The

foregoing certainly greatly facilitates the preservation of prints from abrasion or marking during trimming, mounting, and subsequently when they are handed about for inspection.

Prints taken from the washing water may, if hardened, be at once either squeegeed or mounted after blotting off superfluous matter. Otherwise they should be hung up to dry, and subsequently re-wetted before being squeegeed.

CHAPTER V.

PRINT-OUT PAPERS—Continued.

Collodio-Chloride.—The instructions given in the last chapter respecting the printing and toning of gelatino-chloride paper may be taken as a model for the guidance of what is necessary in most other methods of printing out upon silver paper; and *mutatis mutandis*, the directions given are applicable not only to collodio-chloride, but to albumenised, and to plain salted paper. There are, however, certain modifications called for in the treatment of the last-named papers which I shall proceed to dwell upon. The reader should, therefore, if he happen to be entirely unacquainted with the routine of silver printing, even if he does not intend to print on gelatino-chloride paper, carefully read and master the main parts of Chapter IV. before attempting to apply any of the directions given in Chapters V., VI., or VII. In the writer's estimation collodio-chloride paper is in many ways by far the most satisfactory of all the silver print-out papers. It is, in several essential respects, similar to gelatino-chloride papers, but with the important exception that instead of the sensitive salts being associated with a comparatively thick film of gelatine, they are combined in an emulsion with collodion, in which condition a very thin film is applied to suitable paper. The advantages which I consider it possesses over gelatine paper are: slightly quicker printing; much quicker toning; facility of judging of resulting tones; requires shorter immersion in washing-, toning-, and fixing-baths; can be dried off at once under blotting-paper directly washing is completed; is probably very much more permanent than gelatine or albumen paper. Thus collodion is much less affected by heat than is gelatine, and much less by damp,

two potent factors in print fading. Therefore in hot weather, or in warm climates, in every case collodion paper is to be preferred. Besides which, the native inertness of the collodion does not, as in the case of gelatine or albumen, predispose it to decompose the silver salts suspended in it.

That the paper has its own drawbacks is inevitable ; they are, however, chiefly due to want of manipulative skill on the part of the printer. The two chief troubles are (1) an inclination for some brands of paper to curl up when just placed in the washing water. (2) A disposition for small pieces of the film to become detached during toning, washing, or fixing.

As regards (1): The Paget Prize Plate Company, and other English and foreign firms, now supply paper which is perfectly free from curl. Where, however, a sample happens to be afflicted with curling, the cure lies in employing hot water for the first washing. With most collodion papers this will be found unnecessary.

(2) The liability of the paper to damage is sometimes rather great, while at other times in this respect it gives little or no trouble. To avoid any such injury, use the paper as fresh as possible, finger it as little as needs be, do not keep it over long in the various solutions, take care that the surface is not roughly rubbed whilst the prints are in the solution, and do not let washing water from the tap or any other source fall upon the surface. In point of fact, the prints need gentle handling and just a little thought. In any case, even if some few prints show damage, the proportion of "wasters" will be probably found much less than with gelatino-chlorides, when it is considered how many various blemishes are apt to show themselves with the latter paper. The writer was formerly much troubled with a make of collodion paper, parts of the surface of which chipped off, but latterly, using the Paget smooth-surfaced paper, without any particular care, he has not met with any cases of prints damaged by this defect.

A good point about collodion paper is that it gives an excellent print from a technically good negative. As a

rule, the gelatino-chloride paper will only yield satisfactory results from somewhat debilitated negatives. Another point which the tyro will appreciate is that with the brands of paper which I have tried, hardly any overprinting is called for. The subsequent operations very much follow the course described in the last chapter. In washing, a salt bath is recommended as facilitating toning, and, what is of not less value, it enables the printer to judge how the toning-bath is working. In using a sulphocyanide toning-bath (as on page 43), and this is the one to be recommended for ordinary work, the toning is judged, not as with gelatino-chloride, by holding up to the light, but by looking at the print as it lies in the dish; the print alters little or nothing in the subsequent fixing and washing unless it is in the direction of a slight additional coldness of tone. To avoid any risk of detaching parts of the film, it is well to keep the print in the toning solution face upwards, and not turn it over and over, as described on page 40. The washing and fixing may follow the course already laid down. Prints may then be immediately mounted, or be blotted off, and dried by a moderate heat.

For warm tones use the acetate bath (page 43) or a bath compounded of

Phosphate of soda	...	...	...	...	150gr.
Water	...	...	...	...	1 pint
Gold chloride	...	...	...	...	2gr. or 3gr.

More of the gold may be used if the bath does not work quickly enough; the less the gold, the warmer the tone.

Harold Baker, whose large professional practice entitles his opinion to special consideration, is one out of many photographers who have definitely discarded gelatino-chloride for collodio-chloride; his testimony below appended, originally published in *The Amateur Photographer*, will be found well worth weighing.

“The secret of avoiding cracking seems to be keeping the paper face down in all washing waters, until the toning-bath is reached, when the prints should all be kept face

up; turning over and over, first face up and then face down, *should be avoided* as far as possible.

"The advantages of collodion, which, by the way, is almost the same price as gelatine, are as follow:—A denser negative is required, which needs much less work in retouching, and which can be printed in bromide, carbon, or platinotype; the work of spotting is greatly reduced; fewer prints are spoilt by double toning, defects in paper, etc.; no reticulation is caused by rolling; and much less gold is needed for toning. The paper has some disadvantages; it is best used fresh, and does not keep for a long time, although a week between printing and toning does not seem to harm it; and, when finished, the surface is easily scratched, although I have fewer prints spoilt from this cause than I had finished gelatine prints spoilt by finger marks from gloves of clients.

"In my own practice the prints are washed after fixing for about half an hour, and then spread out to dry; next morning they are trimmed, washed for an hour or more, and mounted with Glenfield starch; they are then placed in a blotting-book and in half an hour are ready for spotting.

"As far as permanence is concerned I have prints which have been exposed to the sunshine for two or three months that are as good as the day they were toned, and that is more than can be said for platinotypes.

"I give simply my own experience. Perhaps all the faults in gelatino-chloride paper were caused by improper manipulation, and others may meet with similar troubles with collodion. Sometimes when travellers try to persuade me to try gelatine again, I think with a shudder of my former troubles, and decline most emphatically."

See also *Transactions of Royal Photographic Society* for July, 1897, p. 264.

Further experience in collodio-chloride paper will be found in an article from my pen entitled "A Promising Printing Process," which appeared in the *British Journal of Photography* for 1895 (Vol. XLII. p. 389). This reminds me that a very satisfactory pure grey and black tone is

easily got upon collodio-chloride paper as follows:—
Prepare

A.—PLATINUM STOCK SOLUTION.

Potassium chloro-platinite	...	...	...	5gr.
Dilute phosphoric acid	...	...	...	1oz.
Water up to	...	...	...	5oz.

B.—GOLD STOCK SOLUTION.

Gold chloride	...	...	...	5gr.
Dilute hydrochloric acid (B.P.)	...	...	...	2½dr.
Water up to	...	...	...	5oz.

Take three parts A, one part B, and eight parts water; the washed prints being ready, immerse them immediately that the bath is mixed.

Toning is complete in two or three minutes. Wash for five minutes and immerse for about four minutes in

Ammonium sulphocyanide	...	...	...	½oz.
Water	...	...	...	1 pint.

Thence put the prints direct into

Hyposulphite of soda	...	...	...	3oz.
Bicarbonate of soda	...	...	...	a small teaspoonful
Water	...	...	...	1 pint

Remove at the end of ten minutes, and wash.

After each batch of prints has been toned, it is advisable to throw away the bath and mix a fresh one. Before doing so, one may, however, test whether the bath remains in working order by trying one print. Should it not tone easily and quickly, the solution may be considered exhausted.

CHAPTER VI.

ALBUMENISED PAPER.

REFERENCE has already been made to the why and wherefore that albumenised silver paper has been superseded by other printing mediums. Nevertheless it is well to repeat and emphasise that one of the chief reasons which have impelled people to relinquish it is the widespread belief respecting its lack of stability. Prints hardly a year old have been found faded; yellowed high lights, bleached shadows, and generally vanishing images have been the rule; others present the appearance of a snow-storm. In fact, the defects due to chemical action set up in the film after the picture was declared "fixed" and finished, are almost without end; all which bad repute is, after all, mainly due to culpable carelessness, or gross ignorance, on the part of makers and photographers. At the same time the public at large are somewhat to blame; for it is they who, by everlastingly preferring the cheapest, have made it unprofitable for printers to buy good material, and use it with due precaution for the future. Hence has risen a demand not for a paper which if properly treated is fairly permanent, but for one which will retain the light-impressed image unimpaired be one never so careless. Gelatino-chloride paper, being perhaps a step nearer the desired goal, has supplanted albumenised paper as much on account of its supposed superior chance of remaining unimpaired by Time, as because of its other qualities. For all which there is very much to be said in favour of the older and once so familiar paper.

First, as regards permanence. I, and no doubt others, have prints taken upon albumenised paper ten, twenty, thirty, aye, forty years ago, which are still bright and

pleasing, and which show less change than do some water-colour drawings of the same age. This proves—if anything—that all those others which have grossly deteriorated have done so from causes which might have been prevented. To examine into all these causes would be out of place in this little book; but I will quote a few words from the experience of Mr. W. Hanson, which go far to explain what are some of the factors in permanence. In 1876 (over twenty years ago) he sent a 15in. by 12in. portrait to the Philadelphia Institution (it was printed on albumenised paper), “toned in the usual acetate bath, but fixed in two hypo baths of equal strength, instead of one. It was mounted with starch on strong cardboard, the back of which was varnished, with shellac in alcohol.” As it was to be sent across the Atlantic, it was lined in its frame and the back varnished as above. Mr. Hanson says it “is as pure, fresh, and vigorous to-day as when I sent it.” (See *British Journal of Photography Almanac*, 1897.) From the above one may read between the lines that Mr. Hanson did not limit his carefulness to points which he touches upon, but was, no doubt, watchful from start to finish, that the print should be properly handled. The importance Mr. Hanson attaches to using two fixing-baths (see also page 45) strengthens the theoretical reasons for adopting this course. (See further Abney’s *Treatise on Photography*, pp. 151-2.)

Apart from any recommendations on the score of permanency, albumenised paper, when on its best behaviour, will produce prints which for robustness of image, combined with quality of tone, cannot be surpassed by any of the newer papers.

Another point in favour of albumen is that it lends itself much better than other silver paper to the printing-in of figures from another negative. Respecting which, if space permit, full directions will be later on given.

Albumenised silver paper is a Saxe, Rives, or other suitable paper coated with a chloride of silver and silver albuminate, *i.e.*, a combination of silver and albumen, which is pure white until subjected to actinic light action, when it turns dark red-brown. The sensitised surface of

the paper is by no means difficult for the photographer to make for himself.

Briefly stated the procedure is as follows. Prepare

Ammonium chloride	10 grammes
Spirits of wine	15c.c.
Water	135c.c.

Then by degrees add albumen to the amount of 450c.c. This is obtainable in the form of the whites of eggs. Captain Abney advises that the above should be shaken up in a bottle with roughly powdered glass, in order to ensure that the albumen is finely subdivided and thoroughly intermingled. Anyhow, thoroughly incorporate the above ingredients into a homogeneous solution, filter through sponge or tow, and float the paper on it for about a minute; dry, and press. The paper will now keep for a long while. Ready albumenised, unsensitised paper as above can be bought of any large dealer. To sensitise, float for from two to five minutes, the greater time in the colder weather, on a silver bath of the following proportion :

Silver nitrate	50gr. or 10 grammes
Water... ..	1oz. or 100c.c.

The strength of this bath may be varied to suit the object in view. To keep this paper, which is, however, best printed and toned at once, it is recommended that blotting-paper should be impregnated with sodium carbonate and the sensitised paper placed between the sheets. Commercial brands of sensitised paper contain an acid which is either incidental to the method of manufacture, or intentionally added, and will keep in fair printing condition for a considerable time; in any case, it is well to bear in mind that the paper is acidified.

As regards the manipulations and baths suitable for albumenised paper, whether home-made or purchased, not much need here be said. But what little there is to call attention to should not be overlooked.

In the first place as regards washing. Whilst before using some toning-baths a complete elimination of the soluble silver salts left in the paper after printing is called for; with others it is needful to ensure that *a little* of the

silver nitrate should be *left in the print* when the latter is placed in its toning solution. As regards the last category two changes of the water should be used, and the second one should show decided milkiness, which is produced by either chlorides, carbonates, or sulphates.

The following toning-baths are those which require that a little of the free silver nitrate should remain in the paper after leaving the washing water as above explained :

(1) Chloride of gold	...	...	...	...	1gr.
Chloride of lime	...	...	...	...	1gr.
Chalk	...	...	...	...	$\frac{1}{2}$ teaspoonful
Water	...	...	...	...	8oz.

Mix the day before using. Keeps. The above tones sepia to black.

(2) Chloride of gold	...	...	...	...	1gr.
Carbonate of soda	...	...	...	...	10gr.
Water	...	...	...	...	8oz.

Must be used soon after mixing. Tones purple to black.

(3) Chloride of gold	...	...	...	...	1gr.
Borax	...	...	...	...	100gr.
Water	...	...	...	...	8oz.

Dissolve borax in hot water, when cool, add the gold, and use at once. The above quantity will tone half a sheet.

The subjoined toning-baths require a thorough elimination of the free silver nitrate from the paper ; prints to be toned in them should therefore be well washed in several changes, or in running water.

(1) Chloride of gold	...	...	...	...	1gr.
Acetate of soda...	...	...	...	...	30gr.
Water	...	...	...	...	8oz.

Mix twenty-four hours before using ; if a week is allowed to elapse between first mixing and toning, so much the better. Keeps indefinitely in the dark ; as it gets used up it can be refreshed by adding more gold, and by seeing that the bath does not get acid. The above tones brown to purple, and is one of the best for all ordinary purposes.

(2) Chloride of gold...	...	...	...	...	1gr.
Phosphate of soda	...	...	...	...	100gr.
Water	..	...	...	...	8oz.

Mix several hours before using.

The above formulæ are given as being good standard baths which are particularly suited to albumenised paper. It is, however, by no means needful to keep to exactly the same proportions. Particularly may the gold be often increased in amount with advantage; the more so when a bath tones unduly slowly. Respecting which point it is to be remembered that toning is not so fast an operation with albumenised paper as with gelatine, to say nothing of collodion.

Before adding more gold to a bath in order to make it work quicker, see that the temperature is, say, up to 65deg. Fahr., or even more, and that the bath is *not acid*; for either a low temperature or an acid condition of the bath will check toning action. Both the paper and the gold chloride contain acids which if unneutralised may together be sufficient to arrest the toning. Caution—an overdose of alkali will throw down the gold, and make the bath inert. Remember, the faster the toning, the bluer or the colder the tone; slow toning produces warm prints.

Fixing is best accomplished by ten minutes' immersion in a 10 per cent. hypo bath to which 1dr. per quart of ammonia has been added. Longer immersion in a stronger bath is less efficacious in removing the silver. (Haddon and Grundy, Photographic Convention, 1897.)

CHAPTER VII.

PLAIN SALTED PAPERS.

PLAIN salted paper is a somewhat vague name which was given to silver paper salted and sensitised without any albumen being employed. Years ago all silver printing was done on albumenised paper; hence this paper, in which albumen was not used, got the name of "plain salted," from which it would naturally be concluded that no organic colloid was ever required for the preparation of plain salted paper. Very frequently this is so, for the size in the paper which is used often supplies the necessary organic substance for helping the silver salts to build up a picture. But in practice it is generally found desirable to add a small amount of some colloid, usually gelatine, to the "salting" solution; this materially helps to keep the image well upon the surface of the paper.

The advantages which the paper offers to the photographer are several. For large and rather hard negatives the results are often surprisingly fascinating; hence a negative which would be scarcely printable by any other method will yield a valuable result on plain salted paper. Again, within limits, the paper is susceptible to variation in the rendition of a negative, according to the strength of the salting, or of the sensitising bath, or of both. Thus for a normal negative, say 50gr. of silver nitrate per 1oz. of water may be used, for a weaker negative up to 80gr., or for a stronger negative down to 30gr. may be employed. Again, it is claimed that with the small amount of colloid present there is a large gain in permanency. Perhaps its chief merit in the eyes of a good many will be that the printer can, without the exercise of any profound skill, prepare the paper for himself, and modify it as regards

colour, surface, or sensitiveness to meet his own particular wishes.

Although, as already said, with ordinary paper, no absolute need arises to employ any "sizing," it is well to bear in mind that the kind of size used in the paper modifies the resulting colour of the print; thus, while gelatine-sized drawing papers yield reddish coloured prints, starch-sized photographic papers (such as Rives') give purple-coloured ones.

Besides variations due to the sizing found in any paper the image is affected by the particular chloride which is employed. Some consider that it matters little. (See *Photographic Times*, Vol. XXVII., p. 51, where will be found an instructive article by Mr. Harry Wade.) Thus sodium chloride, which is common table salt, barium chloride, or ammonium chloride, are available, the last named being usually preferred. Mr. Wade reminds the experimentalist that the equivalent amounts of the three above salts to use are as follow:—100gr. ammonium chloride=110gr. of sodium chloride, or 220 of barium chloride.

I append verbatim the following precise directions he gives:—

"A medium strength of salting bath, for negatives of average density, is 8gr. of ammonium chloride to the ounce of water, and if tones tending to a platinum black are required, $\frac{1}{8}$ of a grain of potassium bromide should also be added to the ounce of water; whilst if results tending towards sepia are required, a minute trace of potassium bichromate should be added—just sufficient to give the bath a pale lemon colour. If the negative to be printed has excessive contrasts, the best results are obtained by weakening the bath to 4gr. or even 3gr. of chloride to the ounce. For 20oz. solution, the formula reads thus:

"Ammonium chloride	...	...	...	160gr.
Potassium bromide	...	...	...	3gr.
Potassium bichromate	...	...	...	1gr.
Water	...	...	...	20oz.

"The paper is immersed in the above for a few minutes, then hung up to dry and stored away under a pressure. In this state, the paper will keep for an indefinite period."

As regards the sensitising—for as yet the paper is not light-sensitive—it has been found that when much less than eight parts of silver nitrate is used with one part of ammonium chloride the image fails to attain full intensity. Hence for the above formula a silver nitrate bath of 60gr. to the ounce will be most suitable. The bath may be made either alkaline with carbonate of soda or acid with 25gr. citric acid to each ounce of silver nitrate; the former yields the better print, but requires to be used, if possible, within a day of being made. The acid paper keeps for about a fortnight.

Amongst other useful points to note is that the finest prints are obtained by hanging up the paper when first taken from the silver bath until just surface dry, and then refloating it on the silver solution.

Mr. Wade prefers to vary the printing quality of the paper, not as many others do, by altering the strength of the silver bath, but by varying the salting solution—strong for weak negatives, and *vice versa*. The paper prepared as above should print out purple, and in the washing water turn Venetian red. Should the print not turn red in about twenty minutes immerse it in a 5 per cent. solution of potassium bromide. Washing in any case must be *complete*. Ordinary toning-baths may be used, remembering to employ them only *half* the usual strength (that is, use twice the quantity of water).

Toning is followed by the usual stop bath of salt and water. Wash in plain water and fix in a 10 per cent. solution of hyposulphite of soda.

Under-printed images may be intensified if when taken from the printing-frame they are, without washing, placed in

Gallic acid	...	...	...	...	...	2gr.
Water	...	...	...	...	...	1oz.

After this proceed to wash, tone, etc.

In using “plain” or, as it is sometimes called, “home-salted” paper, take heed that your negatives are not stained with the silver: to avoid which varnish should be applied to the face of the negative. Professionals generally employ varnish which is flowed on to a warmed negative, much as collodion used to be spread over glass, but many, or most,

people are unable to acquire the knack of doing this properly. These are advised to use what is known as "cold" varnish. Mawson's sell a very cheap and effective preparation, which can be applied with a soft brush, or in which the negative may be bodily immersed. This is especially useful for varnishing celluloid films.

Where a large number of prints are called for, the negative should first be coated with collodion, followed by varnish. Even so, after a few hundred prints have been made, ineradicable red stains will appear. To guard against the irreparable damage which would ensue, it is advisable to make a transparency which can, if need arise, be resorted to for obtaining a duplicate negative.

The following formula by Mr. Lionel Clark is given for those who prefer a starch to a gelatine colloid :

Ammonium chloride	...	...	...	...	120gr.
Carbonate of soda (recrystallised)	...	...	...	...	200gr.
Citric acid crystals	...	...	...	...	60gr.
Arrowroot	...	...	...	...	180gr.
Water	...	...	...	...	20oz.

Mix the arrowroot into a smooth solution with, say, half the water, and boil for a few minutes. Have ready the other ingredients dissolved in the remainder of the water, add this to the former, filter, and use hot. If there is a tendency to a sunken-in appearance with the resulting print, make the arrowroot 40gr. or 50gr. stronger. For sensitising :

Silver nitrate	...	...	...	...	60gr.
Citric acid	...	...	...	...	25gr.
Water	...	...	...	...	1oz.

is a very suitable bath.

Although, as already said, any ordinary toning-bath may be used, provided it is diluted, some have a predilection for the following :

Gold chloride	...	...	...	...	1gr.
Uranium nitrate	...	...	...	...	1gr.
Common salt	...	...	...	...	15gr.
Sodium acetate...	...	...	...	...	15gr.
Water	...	...	...	...	8oz.

Another system found very efficacious is to partially tone the print in a gold and carbonate of soda bath followed by a platinum bath.

CHAPTER VIII.

MISCELLANEOUS PRINT-OUT PROCESSES.

THE papers hitherto described have all been silver printing ones. With the following the image is due to the action of light upon an iron salt, which in its turn, by the aid of potassium oxalate, reduces a platinum salt so that a visible and a permanent image is thereby formed. Later, in describing the platinotype process, which is a partly print-out one, it will be seen that the half visible image which is due to light acting upon ferric oxalate is, in the presence of a solution of potassium oxalate, made fully visible by the substitution of the platinum for the iron.

Some ten years ago, Captain Pizzighelli introduced a paper in which not only the platinum and iron salts were intimately intermingled with a starchy sizing, but the developing agent, viz., potassium oxalate, or another suitable reducer, was also combined with the foregoing salts. Hence as fast as the light reduced the iron salt from the ferric to the ferrous condition, the developing agent dissolved out the ferrous salt, and at the same instant the molecules of the platinum salt, which is associated with the iron, became attracted, so that, as it were, the platinum and iron changed places, the provisional iron-formed image being as fast as it was formed replaced by a permanent platinum one.

The above is exceedingly ingenious and is sometimes surprisingly successful; but, as may be expected, it is a somewhat uncertain paper to use. For in order that the chemical action of the developing agent may proceed *pari passu* with the action of light, the sensitised surface must needs be somewhat damp, moisture being indispensable in order that the action of the potassium oxalate should be

efficiently energetic. On the other hand, moisture is calculated to slow down the action of the sensitive salt.

Apparently the best method to pursue is to use quite fresh paper which has been kept *thoroughly dry*, until shortly before using it is made damp; then, choosing a rather hard negative having clear shadows, print in bright sunshine. The resulting image should present a full representation of the finished print, except that the high lights require clearing in an acid bath, viz. :

Hydrochloric acid	...	...	...	...	1oz.
Water	...	...	...	...	3 pints

(See instructions *re* platinotype which follow.)

If the picture will not fully print out, it may sometimes be induced to become more intense by breathing upon the print, or by steaming it after it has come from the printing-frame.

The simplicity and the permanency of this process are such that it is regrettable it should not be thoroughly reliable, nor suited to fairly weak negatives. At times the writer has, however, obtained very flattering results with this particular kind of print-out paper; on the other hand it has on occasions happened that nothing but disappointment has followed most persistent attempts to attain success.

CHAPTER IX.

PARTLY PRINT-OUT PAPERS.

A PARTLY print-out paper may be defined as one in which the image of the finished print is merely shadowed forth, and requires after-treatment in order that the full strength and detail may be forthcoming. Thus, while a silver print at one stage of its exposure under a negative, virtually shows all that the finished picture will display after toning, fixing, etc., a platinotype exhibits only a ghost of what will eventually turn into a strong print.

Platinotype Paper.—Of the numerous partly print-out papers no better kind can be cited than that known as platinotype—a paper which is coated with certain salts of iron and of platinum. In this, as already explained in the last chapter, the image, which is formed when the paper is exposed under the negative, is built up from ferric oxalate, which has, in proportion to the amount of light acting on various parts, become reduced to ferrous oxalate. The ferrous oxalate is under this condition of a faint greyish tint, whilst the local colour of the paper, where light has acted but slightly, is of a pale mustard-like colour.

So far the print is nothing but an iron one, and is, moreover, a very imperfect and a barely visible image. On floating this partly printed-out iron image upon a solution of potassium oxalate the ferrous salt is dissolved out, and its place taken by the platinum which is mixed with the iron and starch to form the sensitive surface of the paper.

The result of this substitution is that in place of the former weak suggestion of a picture, there is an image which ranges from a full black to an almost pure white. A pale tinge in the whites which remains is due to such of the ferric salt as has not been reduced by light, and

which has not been entirely removed by the potassium oxalate. To get rid of this, the print is placed in an acid bath, which clears the paper of the ferric salt, and the print is then finished.

Good Points of Platinotype Prints.—These are many. At the head of them all stands the claim for permanency; as regards which much may be granted. It hardly seems possible that any great or serious fading can ensue in respect of the actual image formed of platinum. But as far as the high lights are concerned a certain amount of degradation has at times caused trouble; this in most cases is no doubt due to imperfectly dissolving out in the acid bath the unacted upon ferric oxalate. In some cases, perhaps, the mountant has been at fault.

Next to permanence probably nothing, at first, brought platinotype into favour more quickly than the black engraving colour of the image upon the ordinary paper. To-day this characteristic is in some degree a drawback, as pictures which are not warm-toned happen to be at a discount; but in former times, when a photograph meant a brown-toned print on albumenised paper, the black of the platinotype was considered a delightful innovation.

Apart from the colour of a platinotype which is, as will be seen later on, subject to considerable variation, the scale of tone in which it renders the lights or shades of a negative is, for plucky negatives, more pleasing than where gelatino-chloride or similar papers are employed.

Not the least recommendations of the process under consideration are the certainty, simplicity, and rapidity with which results are obtainable by those who acquire a modicum of experience in using what is known as the cold-bath paper. The paper being printed is, under normal conditions, developed within one minute, and can be fixed, washed, and dried within the half-hour. These operations are, moreover, entirely free from that uncertainty of resulting colour and depth which arises when treating silver prints to toning and fixing.

Perhaps the main drawbacks of the paper are that some attention is needful as regards its storage both before and after printing—that is, until development has been

completed; also that the detail which it will render is not so complete as is the case with silver prints. Objection is further made to a lack of that glowing warmth such as a sepia or vandyke-brown "Carbon" print enjoys, which is not attainable with the ordinary platinotype paper as commonly used. As regards which it may be answered that various methods are now available whereby a cold black platinotype may be turned into a brown-toned picture. Moreover, the Platinotype Company make a sepia-coloured paper which, to a large extent, nullifies the foregoing objection. Perhaps if the experienced photographer had to rest content with one printing process platinotype is what he would do well to select.

Varieties of Platinotype Paper.—It is well that the reader should at the outset understand that there are several kinds of paper which are described by the generic name of platinotype, the chief being as follows:—

- (1) Black paper developed on a cold bath.
- (2) Black paper developed on a hot bath.
- (3) Sepia paper developed on a hot bath.

(1) and (2) are obtainable with either a smooth or a rough surface.

Cold-Bath Platinotype.—Those who purpose taking up platinum printing cannot do better than in the first instance thoroughly familiarise themselves with the manipulation of what is known as the cold-bath process. In this the intensifying agent is usually applied to the paper at the normal temperature, say 65deg. Fahr., whilst with the hot bath the solution is used at from 160deg. to 180deg. Fahr.

Printing of Platinotypes.—There is but little that need be modified in the general directions for printing given elsewhere in this treatise, the chief points which call for special attention being as follow:—(1) The need to keep the paper perfectly protected from damp during printing. This is usually effected by placing a rubber, or other waterproof pad between the back of the paper and the back of the printing-frame; instead of rubber a sheet of celluloid may with advantage be used for this purpose. It is well

not to place the printing-frame in any damp vicinity, nor to print during damp weather. Both before and after printing, up to the time of development, the paper should be protected from atmospheric and other moisture, to which end what is known as a calcium tube is generally used. This is constructed somewhat as follows:—

Fig. 15 A shows the tube or case, which is made of japanned metal. At B 1 the lid pulls off; the joint being, when the lid is on, covered by a rubber band, in order that, as far as possible, no air should get into the case. At B 2 is another joint, which is, however, only used when it becomes needful to replace the spent calcium chloride.

Fig. 15 B is a section of the aforesaid. P shows a roll of platino-type paper, preferably enclosed in waxed paper; at D is a false bottom having perforations; under this is placed some thoroughly dry, hard, calcium chloride, which is usually wrapped in muslin (C). The

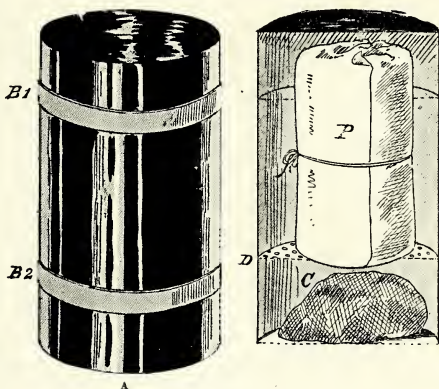


FIG. 15.

action of the calcium is to absorb all moisture, for which it has an extraordinary affinity. Care should be taken that particles of the calcium do not get on to the surface of the paper. The calcium tube is useful for the storage of many other kinds of paper besides platinotype. If the calcium gets soft or damp it should be dried by placing it in an oven, or otherwise heating it until it becomes quite dry and hard.

As regards judging when the image is deeply enough impressed, the best guide will be experience, which, however, need *not* be dearly bought. Thus, take a $\frac{1}{4}$ -plate negative in which the subject is fairly evenly distributed

as regards scale of density. It should be something like Fig. 16, so that any vertical strip will practically contain similar intensities of light and shade.

Now print in diffused light, until you can faintly see the darkest shadows as at A; then, without disturbing the rest of the print under the negative, cut off strip 1. Mark this at the back in pencil with its number, also note the duration of exposure and the quality of light. Continue the exposure of the rest of the negative until on examination B, mainly half-tones, is faintly visible. Cut off 2 and treat as advised for 1. This leaves strip 3, which may be given a further period equal in time to that which 1 has received.

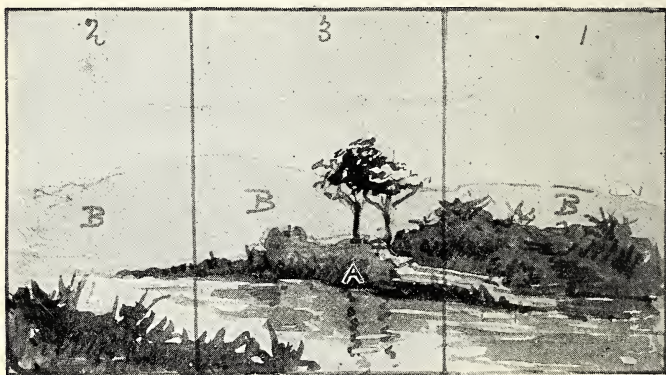


FIG. 16.

Now, in weak light examine the three strips side by side, and take mental note of their appearance. Next float them upon the oxalate bath, giving them each a full time for development (say two minutes); 1 will probably hang fire and refuse to yield a plucky print; 2 will probably come up about right; 3 will probably show clogged shadows and, maybe, degraded high lights. In any case, if through gross error of judgment all three are palpably lacking in perfection, it will be easy enough to see in which direction the fault lies, as there will be apparent a well marked

PLATE I.

APPEARANCE OF A PLATINOTYPE AS TAKEN FROM THE PRINTING-FRAME, SHOWING THE STRENGTH AND AMOUNT OF SHADOW DETAIL WHICH SHOULD BE VISIBLE UPON THE COLD-BATH PAPER.



PLATE II.

APPEARANCE OF THE PLATINOTYPE (PLATE I.) AFTER DEVELOPMENT
AND CLEARING.

improvement from 1 to 3, or from 3 to 1. The former will indicate a need for longer, the latter for shorter exposure.

The Rapidity with which Platinotype Paper Prints.

—In comparison with other sensitised papers, its speed is not a constant ratio, varying with the age and condition of the paper, and with the character of the light and of the negative; but a fully printed gelatino-chloride will usually take rather longer than will a fully printed platinotype. Hence the beginner, by using two negatives of similar character, and exposing side by side gelatino-chloride paper under one and platinotype under the other, may get very near a correct exposure for the latter by taking it out before the former is quite done. In order, however, to enable the tyro to estimate from inspection of the platinotype paper in the printing-frame when the exposure is sufficient two Plates are appended.

The first shows approximately the amount of visible detail and vigour which should appear in the print; the second shows how the same will appear after development in the oxalate bath and clearing in the acid one. Inasmuch as all people cannot with equal facility and at all times gauge the faint grey image with yellow high lights and sometimes slightly orange deepest shadows, and because examining the print from time to time whilst in the printing-frame is calculated to do it no good, the printer is advised to measure the exposure with an actinometer.

For instance, using one of these instruments when putting out a negative to be printed from, the negative can, to begin with, be estimated by inspection to require a given amount of light action; or it can be tested by means of a piece of gelatino-chloride, or by any other convenient paper printed under it, whilst the actinometer is exposed alongside of it to the same light.

In any case the particular amount of light action required is, when determined, registered by reference to the actinometer; this enables the printer to straightway put out his platinotype paper under the tested negative and there let it remain until the actinometer signifies that the required light action has taken place. He may then, if he please, turn back a portion of the paper and satisfy

himself by ocular inspection that the print is fully done before removing it from the printing-frame, although this should not be necessary.

Printing Light.—As regards the quality of the printing light, direct sunshine, except in very extreme cases of unusually dense and yellow negatives, is best avoided; otherwise what is termed “solarisation” is apt to ensue, which entails the loss of vigour in the shadows (especially with the hot-bath paper) and the appearance of an unpleasant granularity, accompanied by a blocking-up of shadow when the cold-bath paper is used. Thoroughly dry paper is less prone to this defect than is damp paper.

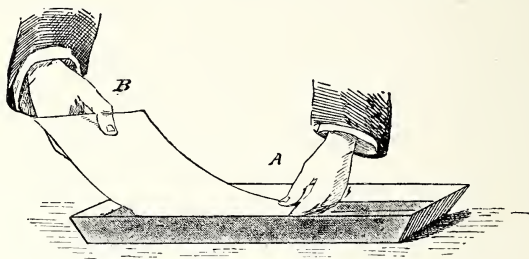


FIG. 17.

Developing Platinotypes.—Regarding this much needless wisdom has been expended; not but what there are niceties of manipulation which no doubt a select few will be glad to observe.*

As a matter of practice a few ounces of a saturated

* I am indebted to Mr. F. P. Wratten, A.R.C.S., for the subjoined note upon the CHEMISTRY OF THE PLATINOTYPE PROCESS, which workers will find well worth mastering:—

Chemistry of the Platinotype Process.—Light reduces the ferric oxalate present in the paper to ferrous oxalate. If hot water be applied direct, some of the platinum will be reduced by the ferrous oxalate; but solution of oxalic acid forms, with the ferrous sulphate, either a soluble double salt, or insoluble ferrous salts, which possess an energetic reducing action. Caustic alkali and alkaline carbonates reduce the ferrous oxalate to ferrous oxide, a well-known reducer.

The oxalate developer should be slightly acid, or insoluble yellow boric iron salts may be formed in the print, which cannot be removed by dilute acids. Thus if the hot-bath developer be used for a long time, the salt which crystallises on the sides of the dish will be decomposed by the heat into potassium carbonate, which will render the developer alkaline, and cause the prints to be yellow. The potassium oxalate may be acidulated with oxalic, citric, or tartaric acids.

solution of potassium oxalate in a clean dish, and at a temperature of not less than 60deg. Fahr. are all that are needful. Take a dry print, hold it face downwards near one end of the dish so that one edge is just close to the surface of the solution (Fig. 17), then with one hand (A) draw the print along the surface of the bath, whilst with the other hand (B) lower the whole sheet into contact with the solution.

If this is properly done, there will be no air-bells, which are to be avoided. Leave the paper for a few seconds, making sure that it is in complete contact, then turn it over and see that there are no air-bells, and that the solution is working evenly. At the end of a period which depends upon circumstances, but which is measured rather by seconds than by minutes, the development will be complete. Although development may be arrested before all the ferrous oxalate is reduced by the potassium oxalate, it will generally be found that a development cut short does not yield a fully satisfactory picture.

Fixing Platinotypes is quickly effected by immersing the prints for not less than five minutes (fifteen minutes in all) in three acid baths, usually

Pure hydrochloric acid	...	...	...	...	1oz.
Water	...	...	...	...	3 pints

The above fixing-bath is less esteemed by me than one consisting of

Citric acid	...	...	...	...	1oz.
Water	...	...	...	...	1 pint

The objections to the hydrochloric are: first, it is inclined to soften the paper; secondly, before admixture with water it gives off somewhat obnoxious fumes.

The foregoing directions include just enough information to enable the ordinary worker to turn out fair average prints. There are, however, a certain number of modifications of treatment with which no doubt many readers will be glad to become acquainted.

Control over Printing Densities.—Negatives and subjects often call for a heightening or lowering of contrast in the printed image. In my opinion one can but rarely

obtain a result of the finest possible quality where a departure from the normal treatment is made, for normal treatment means "best possible," or best known, when applied to matters of printing, development, toning, etc. None the less modifications of the usual results are often attainable which are tolerably satisfactory in character. Thus negatives weak through defects of technique, or of subject, are made to yield slightly stronger or bolder prints by (1) under-printing, (2) strong developer, (3) colder developer, (4) fresh and thoroughly dry paper. A negative with violent contrasts should receive the opposite treatment—(1) over-printing, (2) weak developer, (3) hot developer, (4) slightly stale, and so somewhat damp paper. By damp is meant not any noticeable moisture, but as much as would get into the paper from the air if it were kept in an ordinary box for an hour or two after being taken from the printing-frame. Slight under-exposure of the cold-bath paper may be counteracted by developing at 160deg. Fahr., the resulting tone being warmer than the normal.

Should the developer be diluted, not more than four parts water to one part saturated solution of potassium oxalate should be used, or a condition is approached where part of the image becomes dissolved before the substitution of platinum for iron is effected.

To compensate for over-exposure, and to brighten up prints from weak negatives, Capt. Abney suggests the addition of $\frac{1}{30}$ th of a grain of potassium nitrite to each ounce of developer.

With platinotype the quality of the printing light is less efficacious than is the case with silver prints in modifying the resultant image. An addition of a little acid or a little alkali to the developer will not affect its efficiency, but slightly alters the resulting tone of the print. Alkaline baths yield warm, acid cold tones. Soda, potash, or other carbonates are best used for making bath alkaline.

Glycerine Development.—A few years ago there was a great rage for this system of developing the cold-bath paper; and many were the advantages claimed for it. In some cases it would certainly seem that a glycerine developer is preferable to an ordinary one, in that at times it permits

of some not inconsiderable modification in parts of a print. The method of procedure is extremely simple. The print is laid face upwards upon any convenient support (a piece of glass which has had a few drops of glycerine rubbed on its surface to prevent the paper from slipping is as good as anything). Take some glycerine, which should be pure, and free from acidity, and rub it with the fingers over the surface of the print; when the whole is perfectly covered, apply the oxalate developer with a soft brush; the picture will slowly appear, and may be to some extent hastened in parts by applying more developer to the portions it is wished to intensify. The developer may, in the first place, be applied to the glycerined print diluted with an equal quantity of glycerine, or even further, thus :

Potassium oxalate ...	...	...	...	1 part
Glycerine ...	...	...	...	1 part
Water ...	...	...	...	1 part

By adopting such a weak developer as above more time is allowed for hurrying up portions of a print by means of a copious application of the full ordinary strength solution of the oxalate developer.

Hot-Bath Paper.—As regards the manipulation of this paper not much is called for, as it is now fast ceasing to rank amongst Popular Photographic Printing Processes. The cold-bath paper has almost entirely superseded the hot bath, because not only is it much more convenient to use a bath at a normal temperature than having to heat it up to about 170deg. Fahr., but the cold-bath paper keeps in fair condition for longer than does the hot-bath paper. Practically all the instructions given for printing cold-bath paper by floating or immersion are applicable to the hot-bath paper. The bath should normally be at 160deg. Fahr.; with a thin negative 180deg., or even a little more, is advantageous; with a hard negative half the foregoing temperature, or even less, may be employed.

Sepia Platinotype Papers.—Many who are otherwise perfectly satisfied with the ordinary platinotype paper desire a warmer toned image than is yielded in development by the papers already described. For these there is

the so-called sepia paper—one which is capable, in skilful hands, of yielding prints of a very delightful warm brown hue. The reader is, however, at the outset warned that the paper is by no means so simple to handle, nor so certain in its results, as either of the black-toned papers.

Until recently, unevenness of tones was frequently noticeable with the sepia paper, and even where this was not the case different batches varied very considerably in the particular tone they would give; but of late the paper has been somewhat improved as regards such troubles, and a much more constant and reliable print is obtainable. For development, use:

Potassium oxalate	...	...	...	...	1lb.
Water	...	...	...	...	2½ pints
Sat. solution oxalic acid	...	...	...	...	5oz.

Pour out sufficient to fill an enamelled iron dish an inch deep with the mixture. Support the dish in any

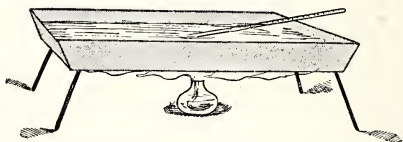


FIG. 18.

convenient manner over a source of heat—a spirit-lamp is as good as anything, as not being too fierce (Fig. 18); when the chemical thermometer shows 180deg. Fahr., the print should be floated on, as already described for the cold-bath paper. Care should be taken that in this floating on of the paper no stoppage or unevenness in wetting of the surface occurs, or irregularity of development may follow. The paper should be left face downwards for at least five seconds, and should not before then be taken off the solution for examination; in from five to eight seconds development should be complete. Until the paper has soaked for five minutes in the acid bath it should be as much as possible shielded from daylight, or the high lights may suffer

degradation. Besides this last source of injury to high lights, they are harmed by (1) exposing the developing solution to much light; (2) using a dish the enamel of which is cracked; (3) stale paper.

Clear and fix as usual in three acid baths in which the print should not be left longer than necessary.

A dish used for sepia prints should not be employed for black ones, nor should the two kinds of prints be cleared and washed together.

CHAPTER X.

PARTLY PRINT-OUT PAPERS—Continued.

The After-Treatment of Platinotypes.—In the foregoing chapter the ordinary operations connected with the production of platinotypes have been described, and nothing more is necessary in order to produce prints of very exquisite quality. At the same time it not infrequently happens that the finished print, for various reasons, is capable of some improvement, either in the direction of colour, or of vigour. Several means whereby such modifications may be brought about have been perfected, respecting which the writer, however, confines himself to the following :—

- (1) Packham's process.
- (2) Uranium toning.
- (3) Dolland's gold toning.

Of the above, the newest and, in the opinion of many good judges, the best process extant for turning black prints into a warmer hue—ranging through a long series of browns—is that associated with the name of Mr. James Packham, F.R.P.S., of Croydon, who first announced his discovery in the year 1895, when he gave a full explanation and demonstration at the Croydon Camera Club, and elsewhere.

The following directions follow my article upon the subject in the *Photographic Times* for June, 1895, where the reader will find more details, as also in another article on the process which I communicated to the *British Journal of Photography*, Vol. XLII., p. 135.

Mr. Packham has laid some considerable weight upon the advisability of, in the first instance, making the black print with an eye to its subsequently being toned brown ;

but in my own practice I have not found such a course necessary. All the prints I have toned were such as I happened to have by me.

The following are amongst the chief preliminary points to which Mr. Packham attaches importance :

(1) The printing should be done in diffused light.

(2) The paper should be slightly stale ; if not so through age it should be left in a drawer, or box, for twenty-four hours before using.

(3) The oxalate bath should be an old one. It may be slightly acidified, as with oxalic acid (yielding yellowish browns), or neutral (yielding medium browns), or alkaline (yielding warm browns).

(4) Various organic substances added to the ordinary developer are helpful. Thus an approved bath is potassium oxalate, 7oz. ; West Indian sugar, $\frac{1}{2}$ oz. Boil for ten minutes in 14oz. of water, and develop cold-bath paper by flotation at a temperature of 100deg. to 120deg. Fahr. In any case the platinotype must be allowed to completely dry before being placed in the toning solution.

The toning solution is compounded as follows :—Compound Tinctorial powder, 1oz. ; Water, 1 pint. Boil for five minutes, allow to cool, and then add 4oz. of alcohol. Of this take about 40 minims to each pint of water, at 65deg. Fahr. In this the prints are immersed, turning them over every hour or so for about six hours, more or less, according to the colour required.

Quick Toning with Hot Solution.—By this system the toning is accomplished in four or five minutes instead of as many hours. Warm the above solution to about 140deg. Fahr. Within one minute of immersion the prints will have probably begun to change, and thereafter pass through various tones of brown in succession ; when the desired one is obtained, the print is placed in cold water, which at once stops further action.

Sometimes the water used in the toning-bath, being heavily charged with lime, causes the solution to become pink, which slightly stains the whites of the print. This may be counteracted by adding 2gr. of either potassium oxalate, or of oleate of sodium, to each pint of the mixed

catechu solution ; these additions cause a somewhat warmer result in the tones obtained. Washing in two changes of water completes the operation.

Quite recently (April, 1897), Mr. Packham has advised that, after toning and washing, the permanency and



FIG. 19.

intensity of the image are aided by immersion of the print for about five minutes in a solution of enough potas-

sium bichromate in water to make the mixture a pale straw colour.

Before leaving this part of my subject some description of the best way to use a hot bath, as above, will be advisable. The toning-dish should be a deep porcelain one, and perfectly clean. It should stand in a metal tray a size or two larger, into which hot water is poured ; if the outer tray contains sand and hot water all the better.

The above is placed over a spirit-lamp, or a Bunsen burner. When the catechu solution registers 135deg. Fahr., the print may be immersed, and, after a minute or two, from time to time taken out for examination ; bright light does not injure the toning in the least. As the hot water makes the paper rather tender to handle, a simple device for getting the paper out is best used ; this consists of a sheet of perforated zinc, one dimension of which measures less

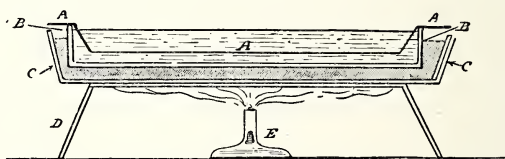


FIG. 20.

than one of the inner dimensions of the porcelain dish, whilst the other dimension of the zinc should measure about 6in. more than the other dimension of the dish. The zinc is bent in such a manner that it reaches to within about $\frac{1}{2}$ in. of the bottom of the dish (Fig. 19).

The whole of the foregoing apparatus, which is much simpler than it sounds, is indicated at Fig. 20, and consists of A, Perforated zinc resting on side of dish; B, Porcelain dish containing catechu solution; C, Metal dish containing sand and hot water, or plain hot water; D, Support for the above; E, Bunsen burner.

The foregoing treatment, besides turning a cold black print into a pleasing warm one, decidedly reinforces the vigour of the image. The procedure is not merely applicable to black prints, but also to sepia platinotype. Pizzighelli, and other print-out platinum paper, may also be treated with the catechu.

It should be added that the ordinary catechu of commerce, and also various kinds of Cutch, and Gambier, which have sometimes been substituted, prove unsatisfactory. The special Tinctorial Powder is easily procurable for a few pence from the large London wholesale houses, or from Mr. Packham, 17, Katharine Street, Croydon.

Uranium Toning (Brown and Red).—To Mr. Fitz-Payne is due the application of uranium for obtaining warm tones upon platinotype.

In order that this toning solution should act with regularity and not produce stains, it is needful that all the iron salts be dissolved out by the acid fixing-bath. Two solutions are made up:

A.				
Uranium nitrate	...	...	...	20gr.
Glacial acetic acid	...	...	...	2dr.
Water up to $\frac{1}{2}$ pint	...	...	...	10oz.
B.				
Ferricyanide of potassium	...	...	...	50gr.
Glacial acetic acid	...	...	...	2dr.
Water up to $\frac{1}{2}$ pint	...	...	...	10oz.

Take equal parts of each of the above, mixed just before using. The toning proceeds slowly, passing through various grades of brown to red, as with the analogous method prescribed for bromide paper by Mr. Weir-Brown; when the toning has proceeded far enough, place the print in weakly acidulated water, say—Hydrochloric acid 1 part, water 200 parts. With this the print may be laved as carbon prints

are treated. If it is found needful to clear the high lights, or generally reduce the tone, plain water will act more energetically than acidulated water; indeed, the whole of the toning may often be washed out by plain water alone, hence after the weak acid bath the print should be only quickly rinsed in plain water and then at once blotted off. An alkaline solution entirely removes the above toning deposit.

A modification of the foregoing has since been recommended by Baron Hübl (*Transactions Royal Photographic Society*, Vol. XIX., p. 57) :

A.					
Uranium nitrate	...	...	...	...	10 grammes
Glacial acetic acid	...	...	...	...	10 grammes
Water	...	...	...	...	100c.c.
B.					
Potassium ferricyanide	...	...	...	...	10 grammes
Water	...	...	...	...	100c.c.
C.					
Ammonium sulphocyanide	...	...	...	...	50 grammes
Water	...	...	...	...	100c.c.

Add 10c.c. of each of above to 1000c.c. of water.

Thoroughly clear and wash the prints, then place in the above solution; toning should be effected in about five minutes. The above, besides toning, slightly intensifies the print, the darkest portions gaining more intensity than the lighter ones.

Blue Tones.—The following bath has been suggested by Baron Hübl for the production of blue-toned images. The ordinary black print is immersed in a mixture of the following :

A.					
Ammonia-iron-alum	...	...	...	...	10 grammes
Hydrochloric acid	...	...	...	...	10c.c.
Water	...	...	...	...	100c.c.
B.					
Potassium ferricyanide	...	...	...	...	10 grammes
Water	...	...	...	...	100c.c.
C.					
Ammonium sulphocyanide	...	...	...	...	50 grammes
Water	...	...	...	...	100c.c.

Mix 5c.c. of A with 1000c.c. of water, then successively add 2c.c. of B and 5c.c. of C.

For convenience' sake B and C have been repeated upon page 82; it will, however, be observed that they are the same as in preceding formula; hence the worker may very conveniently try both brown and blue toning, bearing in mind, however, that the dish used for blue toning, as it contains iron in solution, should not be used for brown toning, or, in spite of careful washing, stains may ensue.

Dolland's Gold Toning of Platinotypes.—Mr. A. W. Dolland's treatment of platinotypes has the following effects:—

- (1) It strengthens a print which is slightly weak.
- (2) It improves the colour of some prints which are possibly of an unsuitable rusty black, changing them into a pure black.
- (3) It enables blue-black prints to be obtained.

With catechu or uranium the alteration in colour is from black to brown—hence a little overtoning is not of great consequence; but with Mr. Dolland's process the change wrought is, besides the intensification of the image, in the direction of blue. In most cases when the image gets a dark blue-black any further action will tend to produce tones which are more novel than suitable for ordinary subjects. Nevertheless I have frequently seen platinotype prints which have gained exceedingly by being subjected to Mr. Dolland's process, used with due moderation. A black platinotype print, preferably one which has not been made for more than a couple of months, is soaked in warm water (100deg. Fahr.), and then laid face upwards on a sheet of warm glass. All surface moisture being blotted off, a thin film of glycerine is gently spread over the face of the print, using either one's finger or a camel-hair mop brush. This done, drop on a few minims of

Gold chloride	...	...	...	...	...	15gr.
Water	...	...	...	...	...	7½dr.

which should be neutralised with chalk, and rapidly brush it all over the surface so that the whole is affected in as regular a manner as possible.

The print should soon begin to gain strength, and at the same time the colour will gradually change from rusty black to warm black; then cold black followed by blue black, until the blue stage is reached. As soon as it is judged that the best effect is attained—and care should be given that the high lights remain unaffected—the print is rinsed in water until the gold and glycerine are removed; after which, in order to ensure the reduction and elimination of any gold compounds, which are liable to be formed with the sizing of the paper, the print should be sponged, back and front, with any convenient alkaline developer, that is not likely to stain. Mr. Dolland recommends the following:

A.

Sodium sulphite	...	...	...	...	1oz.
Metol	...	...	...	...	50gr.
Water	...	...	...	...	10oz.

B.

Potassium carbonate	...	...	...	...	$\frac{1}{4}$ oz.
Water	...	...	...	...	10oz.

Use equal parts of A and B; finally wash for fifteen minutes in running water, or in four changes. Not only may prints be toned in bright daylight, which is often a considerable advantage, but the strong light seems actually to hasten the deposit.

CHAPTER XI.

PARTLY PRINT-OUT PAPERS—Continued.

Silver Chloride and Cyanotype Papers.

A FEW years ago much stir was made by an innovation upon the ordinary method of treating gelatino-chloride print-out papers, which was introduced, or at all events perfected, by Mr. Leon Warnerke.

The innovation in question consisted in treating the above make of paper as a partly print-out one, the imperfect or embryonic image being developed up by means of a suitable reducer. The results which Mr. Warnerke and others either showed me or obtained in my presence, were many of them gratifying, and the system seemed to give the photographer a very considerable additional power of controlling the result possible with a negative; for variations in the exposure, in the character of the developer, and in the duration of development enabled an adroit man to very considerably modify the effect attainable by the ordinary printing-out and toning. The chief drawback was the additional time and trouble involved. On the other hand, where printing light is scarce, the above is a very useful power to employ, for, with about one-tenth or less of the time of exposure necessary for fully printing out, the image is sufficiently impressed as to be developable to full intensity. Since Mr. Warnerke first drew attention to the development of partly printed gelatino-chloride paper, various improvements in procedure have been effected.

Of all these, probably the most satisfactory is the method associated with the name of Mr. William J. Wilson, F.C.S., who, working with the Paget gelatino-chloride

papers, showed what highly satisfactory results were attainable. The treatment in question is also applicable to most other commercial brands of gelatino-chloride paper.

The procedure which I recommend is that adopted by Mr. Wilson, whose lucid directions are in the main followed.

Developing Gelatino-Chloride Paper.—The first point is to consider what is the minimum amount of exposure

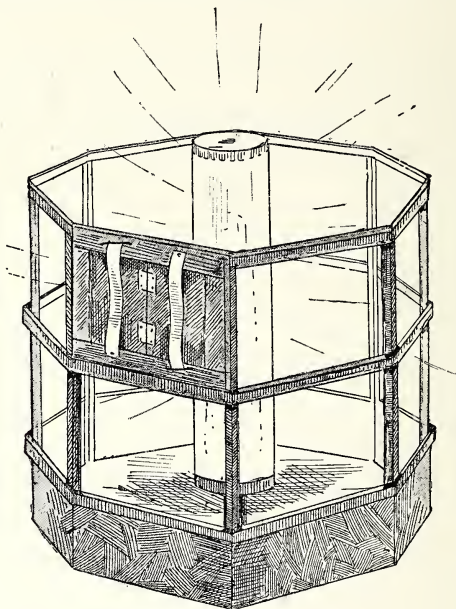


FIG. 21.

which is capable of yielding a print after development. Generally speaking, a *faint* image of the *darkest* part of the subject should be visible—about as much as is seen upon a platinotype is ample. One should bear in mind that fresh paper needs less printing-out than stale paper. With the former an exposure of one-twentieth the amount necessary for ordinary printing-out will be ample. Thus if a *print-out* took half an hour in daylight, a minute and a half of the

same light would be sufficient for a *partly print-out*. This great reduction in the needful amount of light action becomes important where one is dealing with artificial light; for a light—say, from an incandescent gas-burner—which would at the nearest practicable distance take ten or twelve hours to fully print out on gelatino-chloride paper, will impress a developable image in about the time required for getting dishes and solutions, etc., ready for proceeding with the development which follows printing.

Where this method of working is regularly practised, it is well worth while to make a frame-work for exposing a number of prints together. Fig. 21 indicates one out of many other forms which will suggest itself. It consists of a light octagonal frame-work, each side of which measures about 8in.; this will ensure that the light in the centre is distant from the negative about 9in., or rather more. It is not advisable to have the light nearer, for fear of unequal illumination. The above arrangement will accommodate sixteen $\frac{1}{4}$ -plate prints, which is a convenient number to tone at a time. For larger prints, the dimensions of the frame-work must be proportionately increased. Using such a device, with an incandescent gas-light, and employing fresh paper, with clean, clear negatives, one can continue uninterruptedly working for hours. As fast as one batch of prints is developed and toned, the next batch is about ready.

With the developing-up system, great accuracy of time in printing is not needful. Thus, if a full normal time of exposure is reckoned to be fifteen minutes, either ten or twenty minutes would not make very great difference in the result; only the one would need longer, the other shorter development.

Inasmuch as one-twentieth of the usual time is enough for printing, it follows that exposure of the paper to daylight either before or after printing is about twenty times as injurious as where paper is to be fully printed out; hence unusual care must be given as regards shielding from white light. A room lit by any pale yellow light will not hurt the paper; nor will ordinary gas-light do any harm, providing a prolonged exposure to it at close quarters is not given.

Bromising the Print.—The first operation after the print is made is to immerse the paper in a 10 per cent. solution of potassium bromide. The object of this is to convert the nitrates, and perhaps the chlorides, into bromide of silver, the latter yielding an image which is less prone to fog than would otherwise ensue. The action is complete in from five to ten minutes, the shorter time being for fresh paper, and *vice-versâ*; but a longer immersion will do no harm. Two or three minutes' washing should follow, in order to get rid of any free bromide from the paper or film, the presence of which in any considerable quantity would much retard development, as the photographer may know.

Development.—Prints may be developed several at a time; but to begin with, one only should be handled. The time taken to develop varies from about three minutes, or less, to six minutes, or more, depending upon the exposure, and upon the proportions in which the developer is made up, more accelerator shortening the period.

The gradation and force of shadow in the print are largely controllable by the amount of the developing agent used. Thus a developer containing 4gr. of hydroquinone to each ounce of water gives an average result; 5gr. per ounce yields a flatter print; 3gr. per ounce a harder print.

Some judgment is called for in order to decide when to stop development. The danger is in going too far, as the colour of the image being rather pale, the latter is in reality much stronger than it looks. Anyhow, one should usually stop development whenever the finest or faintest details just *begin* to show.

The print is now placed in a stop bath, consisting of a weak —1 per cent.—solution of potassium bromide, thence for ten minutes in running water, or in three or four changes; it is then ready for toning, the bath most in favour being the sulphocyanide one. (*See Chapter IV.*)

Developing Solution for partly printed-out gelatino-chloride papers:

A.					
Hydroquinone ...	...	...	...	...	1oz.
Sodium sulphite ...	...	...	...	...	1oz.
Sulphurous acid ...	...	...	...	...	$\frac{1}{2}$ oz.
Water up to ...	...	...	...	...	40oz.

B.

Potassium bromide	...	...	...	...	2½oz.
Soda carbonate (recrystallized)	...	...	...	...	2oz.
Distilled water up to	...	...	...	...	40oz.

Instead of the above amount of soda carbonate in B, 3dr. of liquid ammonia, strength .880, may be used.

In mixing A, dissolve the hydroquinone in 5oz. of hot water, and the sodium sulphite in the remainder of the water also hot. When the solution is complete, mix and add the sulphurous acid. In making up B, dissolve the potassium bromide in 10oz. of the water (cold) and the soda in the rest of the water made hot; when cool, mix. If liquid ammonia is used instead of soda, mix the latter with cold water, 60deg. to 70deg. Fahr.

The Cyanotype Process is a method of printing much in favour with engineers and others who use it for copying plans. Not a few photographers—especially in the United States of America—also use the paper for taking proofs rather than for obtaining finished prints. Anyhow it is a very cheap, convenient, and simple method of printing; it is, however, open to one serious objection, which is the forbidding Prussian blue colour that the finished print has. This, however, as will be explained, may be got rid of by means of subsequent treatment.

The manipulations are ridiculously easy. Use a strong negative, print in diffused daylight until the shadows are bronzed, and wash the print in plain water. This simplicity is very delightful to many who have become somewhat mixed after practising printing processes which require pretty nearly all the bases, acids, and salts known to the chemist in order that a print may be made.

The explanation of the action which takes place is simply that light reduces the ferricyanide of potassium to ferrocyanide, which latter forms with the ammonia citrate of iron Prussian blue.

As the paper is quite easy to coat, a few hints respecting the required procedure will be acceptable; for many into whose hands this book will fall may chance, at times, to be so situated as to be where all ordinary printing papers are out of reach.

Any good quality paper having a firm, smooth surface may be used. Although it is not absolutely needful to size the paper, a weak warm solution of gelatine, say 2gr. to the ounce of water, is advisable.

The paper is sensitised by applying the following solution by means of a brush or sponge :

Potassium ferricyanide	...	...	...	30gr.
Ammonia-citrate of iron	...	...	...	475gr.
Liquor ammonia	...	...	...	30 minims
Water	...	...	...	6oz.

Note the ammonia-citrate should be a bright brown ; the potassium ferricyanide bright red crystals ; the solution should be of an orange-red colour, or bordering thereon, in any case not inclined to blue-green. After mixing, the solution should be kept from light ; it is best used fresh. The ammonia-citrate may be mixed with half the water, and the other ingredients with the remainder ; the two separate solutions will keep for a few days, or even weeks, if stored in the dark ; equal parts should be mixed just before using. It is advisable to crush the ferricyanide before dissolving it. Solution being complete, add the liquor ammonia, and finally the ammonia-citrate.

To coat the paper, use a flat brush not too fully charged ; have the paper fastened to a slightly slanting board, lay on the mixture rapidly but regularly, by means of horizontal strokes which just overlap ; quickly turn the board, so that what was horizontal is perpendicular, and give the paper another brush over, at right angles to the first. This is, of course, done in a weak yellow light, or gas-light. Hang the paper up to dry ; this should be moderately soon effected or it will print weak, as will be the case if too much solution has been applied. The paper will, before exposure, have a yellow colour, inclining to green, turning blue, and bronzing in shadows where the light acts on it through a negative. An alum bath 1 to 40 after the print is washed somewhat improves its colour.

Various methods of changing the blue colour have been discovered. Of these, one or two are appended. Soak the print in water slightly acidulated with nitric acid, then remove to a 4 per cent. bath of carbonate of soda and

water. After a while, the image will turn a deep orange, whereupon place it in a 4 per cent. bath of gallic acid; in this it becomes black. When dark enough, shift it to a bath of hydrochloric acid, 1 to 200 of water, and finally rinse in water.

Another method of improving the blue is as follows:—Over-print, dip for a few moments in plain water, and immediately transfer to the following:

Liquid ammonia	...	...	...	...	12 minims
Water	...	...	...	...	10oz.

This should alter the colour to purple and somewhat reduce the intensity. When sufficient reduction, or clearing of high light, has ensued, shift the print to the following:

Sub-sulphate of iron (Monsell's salt)	...	$\frac{1}{2}$ oz.
Water	...	8oz.

In one or two minutes the print will take on a dark sober blue, something like that which the Autotype Company supply in carbon for moonlight effects.

CHAPTER XII.

PAPERS WHICH DO NOT PRINT OUT.

Argentic Bromide. — It has already been explained that although there is no absolutely hard-and-fast line which can be drawn between the three main categories of printing papers into which I have grouped the various processes, they are substantially separated the one from the others by sufficiently broad distinctions.

These words of reminder are necessary because whilst in the present section papers in which an invisible image is made visible are grouped together, it will be seen that in some exceptional cases more or less slight visible changes, produced by light action alone, are distinguishable after printing. The first, and at present the oftenest used, if not at exhibitions certainly outside them, is a paper popularly known as

Bromide Paper.—This consists of a suitable paper coated with a gelatine emulsion containing, amongst other things, bromide of silver. The advantages of the paper are manifold. It prints with great rapidity and regularity; develops quickly and easily, requires no toning; lends itself to a wide range of variations in its rendering of light and shade values; and is the most permanent of all the silver papers. *Per contra*, it must be handled in non-actinic light—a bright yellow light such as comes through *canary medium* will not hurt it; it has a tendency to produce hard soot and whitewash prints. The colour sometimes tends to a cold black, which some folk dislike, at other times to a greenish or a rusty black.

As will be seen further on, many of the indicated drawbacks are curable, prints of exquisite gradation and of a warm black tone being possible.

Of the ordinary brands of paper procurable, the chief to which attention may be directed are the following :—Rapid and slow, smooth and rough, platino-matt, and Nikko.

To give an idea of the difference in rapidity between rapid and slow—if the Eastman rapid paper needs one minute, then the slow will take five minutes, the difference in the time of exposure between the Ilford fast and slow paper being as 1 to 10.

As regards surface, the ordinary smooth has a slightly sized surface, of which some people do not quite approve; the platino-matt (which, in spite of its name, contains no platinum whatever) has a dulled surface; the rough is made in various degrees, from a fine drawing-paper up to paper having a rough Whatman texture, of which last Messrs. Wellington and Ward have lately put a brand upon the market that yields unusually telling prints. The Nikko is a make which, with ordinary development, gives a warmer-toned print than the other kinds of paper. It is more suitable for portraiture than for landscape, on account of its pinkiness.

If stored in a dry place and protected from light, bromide paper will keep in fair condition for a time measured by months; after a while deterioration sets in, beginning at the edges, and becomes evident on developing by a degraded condition of the image towards the margin of the paper. The packet or roll of bromide paper should only be opened in a non-actinic light, and even when under the negative should be shielded from all actinic light except that prescribed for exposure.

The light used for printing may, according to circumstances, be either daylight or artificial light. Of the latter almost any kind will do, that oftenest used being gas, electricity, or magnesium, the last generally in the form of ribbon.

One of the main uses to which bromide paper is put is that of enlarging. The details of this cannot here be dwelt upon; enough that an image of a negative is, by the intermediary of a lens, projected on to a screen of white paper the desired size of the proposed enlargement. The image having been adjusted and focussed as sharply as possible,

or as wished for, the white paper is removed; the lens being meanwhile covered, so as to prevent light therefrom falling the while on to the sensitised bromide paper, the latter is pinned where the white paper was taken from. The lens being now once more uncovered, an exposure is made of the required duration, and the bromide paper is ready for the developing-bath. At first some difficulty will be found in hitting the correct time of exposure, which depends upon the speed of the paper and the light falling upon the screen. This last in its turn depends upon (1) the power of the light; (2) the proportion of it which falls upon the negative; (3) the proportion which finds its way through the negative; (4) the number of diameters of the negative to which the enlargement attains. Using artificial light—say, an incandescent gas-burner—and a 5in. condenser, and enlarging a $\frac{1}{4}$ -plate up to 12in. by 10in., the exposure for rapid bromide paper might, with a clean bright negative, amount to about fifteen seconds, with a dense negative up to several minutes. Hence, in order to form an idea as to the needful time, supposing the negative is fairly good and normal, expose the paper for, say, five seconds, replace the cap on the lens, then cover up an inch of the paper with some light-tight material, and, taking the cap off the lens, give five seconds more. Now proceed to cover up 2in., expose for another five seconds, and cover up 3in.; after which continue inch by inch, increasing the exposure by ten seconds each time until 6in. have been covered, then let the increase be at the rate of twenty seconds. You will now have a sheet of paper which has received the exposures shown at Fig. 22.

Assuming that the correct exposure for the particular negative is strip D, then C, B, and A will be found progressively deficient in details of high lights and half-lights; indeed, A will probably hardly show beyond a faint ghost image in the deep shadows. On the other hand, strips E, F, G and H will gradually get darker and darker until little or no high light is left. Probably K and L will be nothing but a misty fog. If the correct exposure, instead of being twenty-five seconds, is two minutes, then, of course, the perfect strip will be J and the falling away will proceed in different directions from it.

Once accustomed to working with a given light, lantern, paper, and developer, and using one's own negatives, there is little or no difficulty in always coming very near the right exposure without testing as above. But unless the tyro has seen for himself with what perfection bromide paper can render a negative, he is likely to go on producing poor class prints out of sheer ignorance of anything better being possible, especially if he be given to slightly under-



FIG. 22.

expose and to the use of a ferrous oxalate developer. For which reason he should make a series of exposures by the means suggested above.

Contact-Printing.—Here, again, the same kind of difficulty will at first be met—namely, gauging the exposure; at the same time, the matter is rather simpler. Using a medium negative at a distance of 12in. from an ordinary bat's-wing gas-burner, with Eastman's slow paper, perhaps thirty seconds will be nearly right. As a test expose for

ten, twenty, thirty, forty, and fifty seconds on the system already advocated. Development will at once disclose the right exposure. Should the negative be either unusually thin or unusually dense, it might happen that even the above range would not include the most suitable exposure; but it would, even in such extreme cases as alluded to, not fail to at once put the printer on the right track.

In calculating the exposure, some account should be taken of the development and other after-treatment to be followed. Thus, a rather longer exposure is found advisable where the acid iron developer is used than where an alkaline one, such as amidol, is employed. Again, if the print is to be subsequently toned with uranium, an image delicate, with an inclination to flatness, is advisable; this means longer exposure than the normal.

Developing Bromide Paper.—At present there is some considerable difference of opinion regarding the comparative merits of the phenol derivatives and of iron as reducing agents for bromide paper. Iron in the form of ferrous oxalate is the developer which, until the past few years, was almost universally used, and those who have hitherto relied upon it are in most cases unwilling to allow that any of the modern developers, such as metol, rodinal, amidol, and the like, can produce results showing such a combination of vivid intensity and complete gradation as are possible with an iron developer. There is much to be said in support of this contention. The iron developer certainly produces very strong and clean pictures, and there is little or no tendency to what is called chemical fog through prolonged development. But there is, especially with the inexperienced, more than an inclination for pictures to be hard, with clogged shadows and blocked lights; there is also more than a risk, with careless workers, of iron stains resembling what is popularly called ironmould. On the other hand, the modern developers—take amidol as a good representative—incline to the production of pictures lacking pluckiness. In order to bring shadows up to full intensity, there is prone to be either over-development or an over-alkaline developer used, chemical fog, more or less pronounced, ensuing.

All things considered, my experience favours the use of amidol, or a similar class of developer, by the amateur, rather than iron. It is easier to manipulate, quicker, and its action is probably more under control, being better understood by the amateur, as he will no doubt be familiar with the analogous action of a similar reducing agent used in developing his negatives. On the other hand, the professional will often find that ferrous oxalate will best do what he wants, as with it the maximum of brilliancy, intensity, and detail, is most surely attainable.

Development with Ferrous Oxalate.—There are several minute but not important variations in the iron developer; that which, in the writer's hands, has always given complete satisfaction is the following, one of the simplest of the various formulæ:

	A.				
Potassium oxalate	...	...	...	...	8oz.
Hot water	...	...	...	...	24oz.
	B.				
Sulphate of iron	...	...	...	...	8oz.
Hot water	...	...	...	...	16oz.
Acetic acid	...	...	...	...	10 minims
	C.				
Potassium bromide	...	...	...	...	10p.c. solution

The potassium oxalate should be a good pure sample; the sulphate of iron should consist of clean green crystals. Shake A and B occasionally, to promote their dissolution; when the solutions are cold, they are fit to use. A should be a water-white liquid, and B a bright green one.

To develop it is important to remember that the iron and the oxalate combine in a certain definite chemical proportion, and that although there may be, without great harm, less than the required amount of iron to combine with the oxalate present in the mixed solution, the addition of more iron than the oxalate can take up will result in the throwing down of an iron deposit, and in the developer becoming muddy and losing its efficiency. Less than the full amount of iron means a weak developer, which is apt, in some cases, to produce prints lacking in vigour.

The full safe proportion of iron to oxalate is 1 to 3.

Making allowance for the different proportions of water in which A and B are dissolved, it will be seen that the developer would stand about 2dr. more of B than is given below.

Remembering that an excess of iron in the developer is to be avoided, it will be understood why one needs to be careful in mixing the ingredients A, B, and C in a certain order, viz., that in which they are alphabetically arranged.

For instance, take of the

	A.				
Potassium oxalate	...	...	...	...	6oz.

into this pour of the

	B.				
Sulphate of iron	...	...	...	...	1oz.

add

	C.				
Potassium bromide more or less	...	...	...	...	10 drops

The above mixture when first made should be of a bright red colour. If it is not, one may assume that there is something amiss either with one of the solutions A, B, and C, with the dish, or measures, or else A has been poured into B, instead of *vice versa*.

The above developer will serve for several prints in succession.

It is well if a number of prints are being developed from time to time to add just a little fresh mixed solution to that being used—say an ounce after every six whole-plate prints have been developed. No hard-and-fast rule can be given; but whenever there seems to be a flagging of intensity in the shadows, or a loss in the purity of the black, immediately reinforce the bath.

Development completed, the *used* bath should be put into a bottle, and kept for future work. Its value is to mix with the freshly-made developer, experienced workers preferring to add a proportion of an old bath to a new, instead of using potassium bromide (C), which latter is, in such a case, omitted.

The proportion of the old to use to the new bath depends mainly, but not entirely, upon the degree of exhaustion of the old, and also upon how long the latter has been kept.

Perhaps one part old to three parts new will be a fair average. Mr. Luboshez, a well-known specialist in this branch, uses equal parts of old and new ; but it should be remembered that he generally works under regular conditions and employs an old bath, whose age is not excessive.

So much as regards mixing the developer. In using it, the following manipulations are gone through. The exposed paper is soaked in plain water until it is thoroughly limp ; a longer soaking is not injurious. The paper is taken out, drained for a few seconds, and laid face up in the developing dish—the developer is poured on. If exposure is correct, and the negative a suitable one, the picture, in about a minute, will begin to appear, and will thenceforth gain steadily in intensity. Some judgment is required to stop development at the right moment. Though on the one hand there is some tendency for development to proceed whilst the print is being withdrawn from the developing-bath, and first placed in the acid washing water, on the other hand the shadows in the dim light look darker than they appear by daylight ; besides which, some slight reduction in the fixing-bath ensues.

The Acid Bath is needful in order to dissolve out all the iron from the paper or film, or an oxide of iron stain results which is ineradicable. The usual strength is :

Acetic acid	...	...	...	...	...	1dr.
Water	...	...	...	...	...	1 quart

After soaking for five minutes in the above the acid is poured off, and a fresh lot poured on. Some like to repeat the operation, thus giving the paper three acid baths. Thoroughly rinse out the acid with plain water, and fix the print in

Hypsulphite of soda	...	...	...	...	4oz.
Water	...	...	...	...	1 pint (20oz.)

Wash thoroughly, and dry face upwards, or hang up by clips.

In some cases it is difficult to tell which is the sensitised side of the bromide paper. Experienced workers, who have sharp eyes, can usually detect which is the more highly sized of the two surfaces, which is felt to be the

smoother. In my own case the sense of touch enables me to decide ; the paper has an inclination to curl inward, the more concave side being the sensitised one ; by passing the finger along the edge one can generally feel which way the paper tends to curl. Another test is to slightly moisten the first finger and thumb, with which grasp one corner of the paper, and hold tight for half a minute. The sensitised surface will stick to the finger or thumb to a much larger extent than the plain ; this is due to the gelatine in the emulsion.

The Alkaline Development of Bromide Paper.—

As regards alkaline development there is this in its favour over and above what has already been said—that the permanency of the print is likely to be greater than where the acid iron developer and the subsequent acid clearing baths are employed. Abney and others have long pointed out the risk which ensues when a print containing acid, even in a minute proportion, is placed in a fixing-bath of hypo. Another point in favour of the alkaline developer is that the acid baths used, between the developing and the washing which precedes fixing, are dispensed with.

The procedure necessary with development follows so normal a course, that but little special instruction is called for. Only this, that the constituents of the developers which follow may with much advantage be from time to time varied, in order to suit the circumstances of any particular print. Diluting the developer produces more delicate tones, with an inclination to want of vigour in the shadows. For over-exposure it is better to rely upon the bromide, or other restrainer employed, than upon dilution to slow down the rate of development.

The first, and I am inclined to think the best developer of all is amidol. We are all so accustomed to keeping the ingredients of developers in solution, and mixing them up when ready dissolved, that some may have a fanciful objection to doing otherwise. I trust, however, readers will, getting over that prejudice, keep their amidol dry until shortly before development, when it should be added to the solution which is to be employed. One of the most approved

formula is the following, for which I am indebted to Mr. A. R. Dresser :

A.

Sodium sulphite, saturated solution.

B.

Potassium bromide, 10 per cent. solution.

C.

Amidol powder (in bottle).

For use take 2oz. (A) sulphite, 40 minims (B) bromide, and 12gr. (C) amidol. The amidol may, with sufficient accuracy, be measured out with a glass, or bone spoon, or by some other convenient means. To begin with, weigh out 12gr., or any other desired quantity. Then get something which will just hold the quantity, so that one can afterwards quickly dip out from the bottle whatever is wanted without being under the necessity of weighing. The image should come up steadily, and neither flash out nor hang fire. Should over-exposure be feared, use more bromide; with under-exposure a small addition of a 5 per cent. solution of carbonate of soda may be used. But my experience of bromide paper is that, as a rule, a perfectly satisfactory result is never attainable unless the exposure has been properly timed.

Various formulæ have been suggested whereby the amidol may be kept in solution instead of being used dry. But in ordinary practice, especially if the work is intermittent, by far the better plan is to use the above as I have directed. It should be added that the above solution of amidol is about twice as concentrated as most people use. The best strength will largely depend upon the character of the negatives employed. Those who find the above developer too vigorous may dilute it by the addition of as much water as originally prescribed for making it up.

Metol Developer.—The following mixed in the order given yields prints not quite so vigorous as amidol is capable of :

Metol	...	...	...	...	...	30gr.
Sulphite of soda	...	...	...	...	...	250gr.
Potassium carbonate	...	...	...	...	...	50gr.
Water	...	...	...	...	...	10oz.

In case of over-exposure being suspected add a few drops of a 10 per cent. solution of potassium bromide. Should the negative be unduly soft, and the print incline to lack vigour, to every 3oz. of the above add 1oz. of the following:

Hydroquinone	...	...	...	...	80gr.
Sulphite of soda	...	...	...	...	1oz.
Potassium bromide	...	...	...	...	5gr.
Potassium bromide	...	...	...	...	5gr.
Water	...	...	...	...	10oz.

It will interest the readers of this chapter to know that the frontispiece is printed on platino-matt bromide paper, manufactured by Messrs. Wellington and Ward, and was developed by means of amidol.

CHAPTER XIII.

THE AFTER-TREATMENT OF BROMIDE PRINTS.

As was pointed out regarding platinotypes, bromide prints are capable of considerable modification and improvement by means of various kinds of treatment which are in the nature of either toning, intensification, or reduction, the net results being that instead of the ordinary tone of the developed print there are produced quite a long and, in a large degree, delightful series of colours. Bromide prints are apt to suffer from a number of drawbacks due not so much to any inherent defect or shortcoming of the process, as to ignorance or carelessness on the part of the photographer. Thus through such causes we occasionally get weak pictures in which grey has to do duty for black; *per contra* we have others in which the high lights are degraded and the details of shadows buried in darkness.

Again there are those prints which suffer with green sickly tones, and others with an unwholesome and forbidding rustiness. In all such cases, and in others where change is called for, one chosen from amongst the following methods of treatment will be found to effect what is desired. Thus, not only may the print be strengthened or reduced by the procedures available, but colours ranging from jet-black through blue-black, blue, green, brown of many shades to red, are attainable.

Toning with Hyposulphite and Alum.—Some old workers of bromide paper may be surprised at reading of toning gelatino-bromide paper in a bath heated pretty well up to boiling-point; for it was for a long while strongly

impressed upon the photographer to avoid even tepid water, let alone that which was boiling. It must, however, be remembered that (1) the new makes of bromide paper differ in manufacture from the old makes in their power of resisting the soluble effects of hot water, which would certainly melt the gelatine off any paper as formerly manufactured. (2) The alum used in the toning-bath in some degree helps in conserving the gelatine from softening. The toning-bath is simply :

Sodium hyposulphite ...	...	...	...	5oz.
Alum ..	...	...	...	$\frac{1}{2}$ oz.
Water ..	...	...	...	40oz.

Of this take a suitable quantity in which to immerse the print, not less than sufficient to cover the dish an inch deep with the solution should be used. An enamelled metal or other similar dish which will stand heating, and which will at the same time not affect the solution, is employed, in much the same way as is recommended for platinotype toning. (*See page 80.*) In this the solution and the contained print are gradually heated until either the required tone is produced, or a temperature of about 180deg. Fahr. is obtained. Some papers will not stand so high a temperature. Therefore, when in doubt, keep the temperature 50deg. lower than the above. This course will, however, entail the print remaining a little longer time in the toning solution. The toning having proceeded far enough, allow the solution to cool; when it is down to about 60deg. Fahr. the print may be removed and dried.

In this process some, more or less, reduction of the image takes place, for which due allowance must be made. That is to say, the print should be slightly over-developed. It is, however, to be remarked that an alum and hypo toning-bath which has been formerly used—*i.e.*, an old bath—does not reduce the strength of the image to nearly so great an extent as does a newly mixed one. The print is best taken direct from the fixing-bath and without washing placed in the above toning-bath.

Apart from the agreeable colour which is yielded by the foregoing, some there are who claim that additional permanence is ensured by this treatment. Thus, Mr.

Luboshez asserts that the long immersion in the hot bath clears the fibre of the paper from casual impurities. Further, that the toned image being formed of sulphide of silver is more stable than the displaced image.

The above bath will tone a bromide print without being heated; the action is, however, very slow, taking about fifty hours. I cannot, however, personally vouch for the action of the cold bath.

The Uranium Toning-Bath.—This instead of reducing the strength of the print, as does the alum and hypo toning-bath, distinctly and materially intensifies the black or grey image submitted to its toning action. Wherefore in making a bromide print which is to be subsequently toned in an uranium bath see that the exposure is rather fuller than usual, and that the development is rather less than ordinary. The object in view should be to produce a print showing pure high lights and delicate gradation down to grey-black, just stopping short of the full black possible in a good bromide print.

In order to attain this end, a suitable developing agent should be used; whichever is chosen, on no account is it advisable to select the ferrous oxalate developer, or any other developer containing iron, because an exceedingly minute trace of iron in the fibre of the paper or in the gelatine will assuredly be turned green by the action of the ferricyanide in the toning-bath.

Either hydroquinone or rodinal is very suitable for developing up a visible image, both have received special commendation for the purpose; but there is no good reason for preferring them to amidol, metol, or any other of this class of reducer, with which the photographer may happen to be accustomed to work.

A suitable exposure having been given to the bromide paper, all the after manipulations are carried out exactly as described in Chapter XII.

The modifications begin after fixing. First as regards washing; this must be unusually perfect, the presence of traces of hypo being almost sure to spoil the print. (For a test of hypo being present in the washing water, see Chapter IV., Washing after Fixing, page 47.) Those who

are troubled with stains—usually reddish ones—due to “hypo” left in the paper, may ensure the complete elimination of the fixing salt in question by immersing the prints for five to ten minutes in

Peroxide of hydrogen (10 vols.)	...	...	1oz.
Water	...	...	20oz.

After this wash for five minutes.

The toning agent is an acidified mixture of uranium nitrate and potassium ferricyanide. The ingredients do not keep well mixed; therefore the best plan is to have them separate in 10 per cent. solutions.

Just before the bath is wanted for use, make it up in the following proportion:

10 per cent. solution of uranium nitrate	...	1dr.
” ” ” potassium ferricyanide	...	1dr.
Strongest glacial acetic acid	...	2dr.
Water	...	6oz.

This bath is susceptible of considerable variation; thus Mr. Brown originally recommended $\frac{1}{2}$ gr. per ounce of uranium and of ferricyanide, and 15 minims of the acid. Mr. Haddon suggests that it is advantageous to increase the proportions of uranium to ferricyanide. Mr. S. H. Fry has advocated 2gr. per ounce of uranium and ferricyanide.

The print, if dry, must be thoroughly soaked in water, and placed in a clean dish containing the solution at the normal temperature, meanwhile rocking the dish to ensure an even deposit. The toning action should begin soon after the print is in the solution; when the desired colour is seen, do not immediately take the print out of the bath, but let it remain until a *slightly* warmer stage is reached. This because the subsequent washing dissolves out some of the uranium.

Washing.—This requires to be critically and carefully accomplished; not because there is anything noxious to permanency which is thereby removed, but in order that enough, and yet not too much, of the toning material may be washed out. Unless toning has been unusually slight, when the print is removed from the toning solution the high lights will be found to be tinted, more or less, dark

straw colour. Running water will wash this out of the high light in about ten minutes, or less; this washing out, however, goes on all over the print, hence the need for some slight over-toning, and for careful watching.

The changes brought about in the toning-bath follow, in regular order, through pale brown, full dark brown, to reddish-brown. One more direction is that when washing is complete do not let the print dry spontaneously with all the surface water upon it, but blot it off between white clean blotting-paper. Although ordinary blotting-paper may be used the chemically pure, fluffless kind sold for photographic purposes is best.

Red Tones.—In this case it is needful that the original print should be developed up further than would be desirable if an ordinary black print were aimed at. The reason for this is that the image of the finished print, instead of being formed of a strong silver salt, is built up entirely of the visually weaker red of the uranium deposit, the latter being substituted for the former, and *not*, as with brown tones, being added to the silver image. Therefore see that all details are well out, and especially that the half-tones verging on high lights are well marked. Proceed to tone as for brown tones, but carry the process until a strong black-red is obtained. Then, having washed in water until the high lights are cleared, immerse in the following:

Hyposulphite of soda	...	...	...	...	...	½oz.
Water	...	...	...	...	...	20oz.

Add to this a few drops of ferricyanide of potassium until the clear solution turns a pale yellow.

In the foregoing the print should change into a picture closely approaching in colour what is known as “Bartolozzi red.” This change is brought about by the last solution—known as Farmer’s Reducer—dissolving out the whole of the black silver image while leaving the uranium unaffected.

Sometimes ammonia, or other alkali, is added to Farmer’s solution in order to prevent its staining, which it is apt to do, where too much ferricyanide is used; but with uranium-toned bromides it is important *not* to have any ammonia

or other free alkali in any of the solutions, as an alkaline bath will infallibly attack and completely dissolve out the uranium.

Green Tones.—In this the original may be developed, and otherwise treated, as for brown tones. The toning should, however, be carried on until a red-brown is arrived at, the reason for which being that the ultimate tone is less dense than the intermediate one. Washing having been duly performed, place the print in the following :

Perchloride of iron	...	...	...	...	1oz.
Hydrochloric acid	...	...	...	...	2dr.
Water	...	...	...	...	40oz.

This bath should act slowly, and thus enable the photographer to watch the gradual change from red-brown to green and blue. It is a matter of taste how far to carry this—probably the most satisfactory results ensue when the blue tint has not gone far enough to entirely kill the warmth in the deep shadows; whenever the moment arrives that the print is considered done enough, it should be placed in running water, blotted off, and dried.

Cautions.—In carrying the foregoing manipulations to a successful issue, the following general cautions respecting the treatment of bromide with uranium, are given. Blot off quickly and perfectly all surface water after washing, or a smudgy and uneven effect may ensue. Wash out all hypo before toning, or red markings will appear. Do not use a toning solution which has been long mixed, or a green stain may come over the whole print. Properly fix the print before toning, or however carefully washed, double tones may follow.

Some advocate that the toning should be done by means of an application of the toning agent with a tuft of cotton-wool. Thus, soak the print in cold water, lay it face upwards on glass, and rub it into contact with a big lump of cotton-wool which has been saturated with clean water. This done, squeeze out all superfluous water, dip the wet wool into the uranium and ferricyanide toning solution, which is gently rubbed over the print until toning is complete. How far this is satisfactory, I cannot state, neither having tried it myself nor seen it done.

Blue-Black Tones.—It often happens that, as with platinotypes, which are improved by Dolland's process, bromides require some slight reinforcement both in strength and in colour; for which purpose they may be treated to an ordinary gold toning-bath.

Ammonium sulphocyanide	...	...	...	30gr.
Gold chloride	...	...	...	2gr.
Water	...	...	...	10oz. ($\frac{1}{2}$ pint)

Dissolve the ammonium sulphocyanide in 8oz. of the water, the gold in 2oz., and pour the latter gradually into the former, stirring it the while.

If the image is marred by an inclination to greenness, it can be toned, after fixing, to various pleasanter hues, ranging from brown to blue-black, according to the extent of action, by submitting it to an acetate bath, made up as follows:

Sodium acetate	...	...	...	30gr.
Chloride of gold	...	...	...	1gr.
Water	...	...	...	7oz.

CHAPTER XIV.

THE PIGMENT PHOTO-PRINTING PROCESSES.

PICTURES produced by the above are best known to the ordinary public under the name of *carbon* or *autotype* prints; but it has been repeatedly pointed out that the description “carbon” is misleading, inasmuch as many so called carbon prints have no carbon whatever in their constitution, the colouring matter consisting of various umbres, madders, and other substances. At the same time it does not follow that none of the prints are dependent, in part or in whole, upon carbon for the visible image; on the contrary, carbon frequently does enter into the preparation of the prepared surface, which is affected by light.

The term autotype is merely a commercial name adopted and popularised by the Autotype Company.

Amongst the advantages claimed for that particular pigment process known as carbon, in which the picture is *developed from the back* of the exposed surface, are that:—

(1) The exact tint or colour desired can be repeated with certainty for any number of impressions.

(2) A variety of colours is available; in fact, the choice is almost endless.

(3) Absolute permanency is assured.

(4) It is as well adapted to copying line work as to half-tone work.

(5) Is quite easy and certain in results when skill and experience are available, and when the light is good.

(6) The results are greatly admired by people who claim the possession of art culture.

(7) It is cheap.

On the other hand the manipulations of the above pigment process being so different from the ordinary operations with which most photographers are accustomed—such as silver printing—a short apprenticeship must be served before one can become used to the ways which are peculiar to the process.

As regards permanency, if absolute unchangeableness is meant, the claim cannot for all cases be allowed. Those tendencies to chemical decomposition and fresh combinations, which are due to the unavoidable leaving of injurious chemicals in the photographic film or support, are perhaps not likely to be present in the pigment process; but certainly if carelessness of manipulation is the rule the image may suffer considerable degradation in the lights due to the potassium bichromate not being thoroughly eliminated, this eventually turning the print yellow in the high lights. Again, some of the colouring matter used may itself not be absolutely permanent under light influence; indeed many pigments are notoriously liable to serious change by the action of sunlight, some of those referred to being at times employed in making pigment paper. How far damp and weak acids may in time affect the gelatine surface, is a matter for investigation. Anyhow, although perfect immunity from the action of all ordinary chemical and physical agents in altering the appearance of the print may not be granted without reservation, the pigment process under consideration is probably not less permanent than any other photo-printing method at present known.

The Composition of Pigment Prints.—Before explaining how to print, and to develop, it will be well to describe how the printing surface is made, and why it is sensitive to light action. A suitable paper is first coated with a preparation of gelatine dissolved in water with which colouring matter is mixed. When dry, the pigmented gelatine is floated on a 5 per cent. bath of bichromate of potassium; this sensitises the gelatine.

Ordinary gelatine is, of course, highly soluble in hot water, but when mixed with potassium bichromate it, in common with other colloids, has the property of becoming insoluble under the action of light. This insolubility is

proportional to the intensity of light. Hence when we have a layer of bichromated gelatine, containing a pigment exposed under a negative, it is not difficult to imagine what follows. Where the shadows in the negative are clear, the light makes a thick layer of gelatine insoluble; where the half-lights are half opaque, the layer of insoluble gelatine formed by light action is thinner; where the high lights, represented in the negative by *strongly* opaque deposits, are, light action will be so weak that practically no gelatine will be made insoluble. If now this exposed gelatine film is submitted to the action of hot water, all the gelatine not made insoluble by light is dissolved out, carrying along with

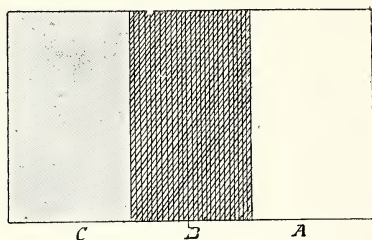


FIG. 23.

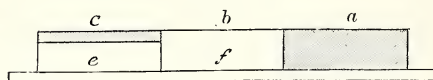


FIG. 24.

it the colouring matter which was mixed with it. It will result that we shall get a positive image of the negative, with all the lights and shadows faithfully rendered; that is, providing the exposure and after manipulations have been correctly carried out.

Perhaps Fig. 23 will make this clearer; it is a

diagrammatic representation of a negative, A (clear glass) representing deep shadow; B, high lights; and C, half-tones. Fig. 24 is an exaggerated section of a piece of the pigmented paper showing the action set up by light after due exposure under negative shown at Fig. 23.

At *a* the whole of the gelatine has been made insoluble; at *b* none has been affected; at *c* a thin layer has been made insoluble. Thus is it that we get a picture of the negative; but until water has removed the soluble gelatine and the accompanying pigment, the change wrought by light is invisible. To make the change visible it is requisite to

get rid of the gelatine at *e* and *f*. (See Fig. 24.) But in practice, even upon the high lights, there is a more or less thin layer of insoluble gelatine over all the surface of the print, which, while not sufficient to degrade the high lights, prevents that access of water to the back of the film that is necessary in order that the unacted upon gelatine should be washed out. For this reason the pigmented gelatine is applied to paper from which, after exposure, it may be detached during the process of washing away of the soluble portions. This detachment is effected by squeegeeing the exposed print to a prepared surface—usually paper—and thereafter stripping the paper upon which the gelatine film was supported during printing. By this device the unacted upon, and therefore soluble, gelatine may be washed away with facility and completeness from the back of the exposed film.

Having briefly explained the rationale of the process, the reader will be better able to understand the directions which follow regarding printing and developing.

Printing the Pigmented Gelatine.—The paper used in the process under consideration may be either (1) wholly made at home ; (2) sensitised at home ; (3) purchased ready made and ready sensitised. The present directions, being mainly introductory, will be confined to the last of the above three categories.

Ready-sensitised paper is obtainable in various shades of brown, including “photographic purple,” sepia, and vandyke, black, red, green, and green-blue, and is sold cut to the various standard sizes, or in rolls. It can also be made to order in any desired shade.

Assuming that the pigment paper—better known as carbon tissue—is received ready sensitised, which for the beginner is much the better plan, it should be used with as little delay as possible. As a rule, the paper will not remain in good active condition more than ten days after it has been sensitised: in some cases it deteriorates even sooner. When received, the paper is best kept under pressure, in order to exclude atmospheric influences, the point being to prevent the access of air, damp, and light. This precaution is also necessary

between printing and developing. Before exposing the paper under a negative it is requisite to run a narrow border of some more or less opaque substance known as safe-edge round the edges of the negative; this must be applied to the glass side of the negative. For the purpose in question many employ black varnish; but more convenient and easier to apply are strips of the paper used for binding lantern-slides, these being gummed on all round.

Fig. 25 will make this point clearer. A is a negative as ordinarily used; B one having a safe-edge applied to the glass side. While white paper is unsuitable, a paper—or other substance—which allows a faint transmission of the light employed in printing, is better than a binding which is absolutely light-proof. The sensitised paper, when unpacked, will be found to be white, or cream, upon one

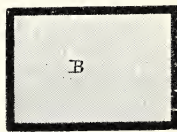


FIG. 25.

side, and on the other side black, brown, or otherwise, according to the colour ordered; the coloured side is the one which is to be placed in

contact with the negative. Exposure not producing any visible effect whilst the paper is in course of printing, it is needful to resort to an actinometer in order to judge when the light action has gone far enough. Under normal conditions, the amount of light necessary to produce a good developable image may be considered equivalent to what will print a “pretty” image upon ordinary brands of gelatino-chloride paper (P. O. P.). By “pretty” image is meant one which shows the picture with high lights nearly pure white—much as the silver print should look as regards detail and effect after toning and fixing.

The reader is, of course, aware that under ordinary circumstances, when printing on gelatino-chloride and most other silver papers, the image is considerably over-printed to allow for subsequent loss in washing, toning, and fixing. (See Chapter IV.) In winter, or in light which is of low actinic value, pigment prints are relatively quicker printing

than are silver prints; wherefore the above calculation is somewhat qualified by variations in the photographic values of sunlight. The speed of printing being as above, it is obvious that in gelatino-chloride, or similar paper, we have a most convenient means for seeing the amount of light action which has impressed an invisible image upon the pigmented gelatine. Taking advantage of this, many, to begin with, time the exposure of their pigmented gelatine by submitting gelatino-chloride print-out paper to the same light, under a negative of similar intensity. The writer has known several instances where photographers, by adopting this course, have, at the very outset, regularly obtained pigment prints which, as regards correct exposure, left little or nothing to desire. If when making a first trial as above, by means of a pair of negatives of similar printing quality, there is a known intention to eventually print off a number of pigment prints, it will be advisable to register the correct measure of actinic action called for by means of an actinometer. Such an instrument, put out along with the prints, will yield a certain reading, which, being recorded, enables the printer, on any future occasion, and within *very extreme* variations of daylight intensities, or qualities, to infallibly repeat the exposure. Thus whilst with a given negative, paper, etc., the correct exposure might on one occasion amount to fifteen minutes, on the next occasion perhaps twenty times as much, or five hours, would be required; this the actinometer will indicate.

As regards the sensitiveness of the pigmented gelatine, it is at its lowest degree immediately after sensitising. During the few following days its rapidity of printing slightly increases; or perhaps it would be more correct to say that a kind of inclination to general insolubility is set up by time, which requires but faint light influence to start its action, even in the portions which are well shielded by the negative. Hence a shorter exposure than usual seems to have a greater effect, this being mainly in the direction of a general flattening of the picture. The tendency to insolubility after a time proceeds apace, until in about ten or more days the greater part of the pigmented film becomes insoluble, with the results that—

(1) The back of the film being insoluble, it is impossible to strip off the support, as explained below.

(2) When the action stops just short of the foregoing, the general surface of the print being in great part insoluble before exposure under the negative, a condition of fog shows itself similar to what over-exposure would yield. From which it will be seen that the age of the paper, reckoning from the time of sensitising, exercises a considerable influence upon the print which a particular negative will give. Another point to take note of, is that the paper is subject to what is known as a "continuing action" of the change set up by light. Thus a print which has been considerably under-exposed, if put aside for twenty-four hours, will develop up as well as if a full exposure had been given to it.

This continuing action is not unlimited in its range; that is to say, if keeping the print for sixteen hours gives a certain increment of addition to the light action which we will suppose equals X, thirty-two hours' keeping will not produce an effect equal to 2 X.

Captain Abney states (*Instruction in Photography*, ninth edition, p. 328) that giving only one-eighth of the known full exposure by keeping the print for sixteen hours in the dark before development, it came out fully printed in the developer. A damp condition of the atmosphere seems to be one of the conditions necessary for this continuing action.

Development of Pigment Prints.—When the print comes from the printing-frame, it will appear just as it was before being put into it, *i.e.*, supposing that black paper is being used, one side will be white or cream, and the other something like a dull sheet of black sticking-plaster. This black film, however, has hidden in it the positive which has been printed through the negative; but, as before explained, in order to make the image visible one must wash away the gelatine, to effect which it is needful to get at the back of the film. This is accomplished as follows: the exposed film is first fixed upon another piece of paper, the paper upon which the film was originally stuck is then removed.

The foregoing operation is a very simple one. The sheet

of pigmented paper, which has been exposed, is placed face downwards in a dish of cold water. In this it will, to begin with, curl up more or less slightly; in a short while it will, of its own accord, straighten out; when it does so, it should be at once squeegeed on to a suitable piece of paper. This, which is procurable where the printing paper is got, is a paper coated with gelatine which has been rendered insoluble. This prepared paper should be slipped into the water directly after the print has been put in to soak so that its gelatinised surface is *vis-à-vis* with the pigment film. The last being ready for squeegeeing is, whilst under water, brought into contact with the sheet of paper; the two are taken out of the water whilst in contact, and placed upon a board or any other suitable flat surface, and, the print being uppermost, the two surfaces are thoroughly pressed into intimate contact by means of a squeegee vigorously employed. By most people the best form of squeegee for the purpose is considered to be the ordinary one, consisting of a strip of rubber fitted into a strip of wood; others advocate the roller squeegee. I have used both with good effect.

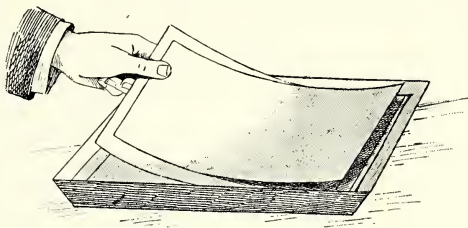


FIG. 26.

Some knack is needful to get the print properly in contact with its support, and to exclude all air-bubbles. The support used should measure in length and in width about 1 in. more than the print; whilst the two are in the water, the print being on top, arrange one over the other so that a fairly even margin is allowed all round, then getting one side of the print parallel with one side of the paper press the two together with fingers and thumb of the hand, or, if necessary, use both hands, and slide the paper out of the dish so that as it comes out the whole of the two surfaces are brought into contact in due sequence (Fig. 26). The

action is analogous to, but different from, what happens when paper is "floated," and, if properly performed, ensures the absence of air-bubbles and of irregular contact. The two surfaces being squeegeed, place them between blotting-paper, and under a weight, for not less than ten minutes.

Developing-Bath.—Meanwhile get ready the developing-bath, which, as a rule, consists of nothing but hot water. Any dish that will stand heat will do for this; it should be supported over a spirit-lamp, or Bunsen burner,

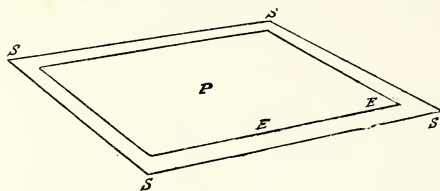


FIG. 27.

or any other heater, and a temperature of about 110deg. Fahr. should be kept up. Should all conveniences as regards dishes and heating appliances be absent, it is not impossible to do without them, providing a can of boiling water is at hand, together with some cold. By this means water at 110deg. Fahr. can be mixed and the temperature kept at about that point until development is complete, by from time to time pouring in more water at 212deg. Fahr.

The print having had at least ten minutes between, the blotting-paper is placed in the hot water, that which was originally the face of the print being downward.

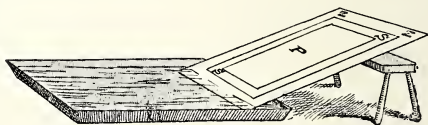


FIG. 28.

In Fig. 27 S S is the new paper support; P the print with its face squeegeed on to the new support, and the old support uppermost. In a few seconds, if all is well, one should notice some of the pigment oozing out along the edges of the paper. This is diagrammatically shown at E E; when this happens, slide a sheet of any convenient flat surface, nothing being better than zinc, into the bath so that the greater portion of its surface is out of the water (Fig. 28).

The print is then laid upon the zinc and the back (P) is taken by one corner and gently stripped off the support (S). Should the back (P) seem to resist being pulled off, replace the print in hot water for a few seconds longer, meanwhile slightly raising the temperature. Should the back still refuse to come off, or if force enough has to be used to cause the film underneath to become in parts detached from the support (S), it may be considered that general insolubility has set in, probably either through keeping the paper too long after sensitising, through the injurious action of damp, or through light fogging the material.

The back of the print being peeled off, and its paper support resting upon the slanting sheet of zinc (or other convenient material), by means of a shallow cup, or even the hand, hot water is poured over the black surface. Very soon the high lights will begin to appear, followed by the half-tones, the shadows being formed of what is least affected by the washing water. This washing off can proceed for some time without injury to the print, and, in some cases, an appreciable modification of what would otherwise develop up is possible. The zinc upon which the print lies may be occasionally turned round so that a more even action of the washing off ensues, and the print may be also immersed in the water.

Unlike most other processes of development, in this the further the development is carried, the weaker the shadows become. Hence the need not to over-develop, or a starved image will result.

At times difficulty is met with in getting brilliancy of high lights, due to the washing out of the pigment hanging fire. To obviate this, various expedients have been suggested. The writer's experience favours the use of liquor ammonia, and an increase of temperature of the bath. Thus, if developing a $\frac{1}{2}$ -plate print an ounce or more of a 10 per cent. solution of ammonia may be added to the bath; this will, as a rule, be found to fetch off a perceptible amount of pigment from the high lights, especially if the temperature of the bath be raised to 130deg. Fahr.

Treatment after Developing.—As soon as the print is considered sufficiently done, transfer it to a vessel of cold

water, which will at once stop further action. A number of prints may be successively placed in the cold water, and there remain preparatory to treatment in the alum bath. The uses of this last are to (1) complete the insolubility of the gelatine film in which the developed picture is held; (2) to discharge any free bichromate salt left in the film. After about ten minutes the print may be taken from the alum bath, given a good rinse in cold water, and hung up to dry. The alum should consist of a 5 per cent. solution :

Alum	...	...	...	...	...	...	1oz.
Water	...	...	...	...	...	...	1 pint

Should a yellow stain be visible in the high lights, it may be considered due to the alum bath not having properly effected its work in dissolving out the bichromatic salt. The obvious remedy is to at once re-immerses the print in the alum.

Single and Double Transfer.—The particulars already given are quite sufficient to enable the reader to turn out excellent prints, and the routine will be found much simpler than it reads. One matter, however, which has not been touched is that in the print finished off as above described the image is a reversed one. Under ordinary circumstances a print from a negative yields us a view in which right and left are rendered as we see them; if we look through the back of such a print, what was right becomes left; and type-printed lettering if present becomes reversed, and therefore illegible.

Having, as explained in developing the pigment print, squeegeed its front on to a paper support, stripped what was its original support from the back of the film, and developed the print from its back, it will be seen that we have the equivalent of what would appear by looking at an ordinary silver print from the back instead of in the usual way. In a great many cases this transposition of image is of no consequence whatever. But with topographical views, with all scenes in which writing is visible, and usually in portraiture, a facsimile rendition becomes absolutely requisite. Several courses are open to obtain this. One is to make a reversed negative, *i.e.*, a negative in which the right and left of the original negative are transposed. A

second expedient is to employ a film, either a thin stiff one, as, for instance, is used in the Frena Camera ; or a thin rollable one as used on the spools of a Bullet Camera ; or paper negatives such as Wellington and Ward supply may be availed of. But those who become fascinated by the charming and enduring possibilities of this form of pigment-printing usually obtain the re-translation of right and left by adopting what is known as the double transfer system. In this the face of the print is, after being developed as described, squeegeed into optical contact with a sheet of paper, and, when dry, the paper, or other support, upon which the print was held during development is stripped off, with the result that we have the print seen from the same side as was originally next to the negative in the printing-frame.

All the procedure is exactly as already explained for "single transfer," except that some of the materials differ, and that there are two squeegeeings and strippings instead of one.

The temporary support oftenest used is a specially prepared paper, which is surfaced with insoluble gelatine and lac. Before use it is treated with a waxing compound which is best bought ready mixed of a photographic dealer. Those who prefer to try and make their own may use the following :—Dissolve 18gr. of yellow resin in 1oz. of turps, and add thereto 5gr. of yellow wax. Anyhow, before the temporary support is availed of, it must be waxed. The usual method of doing this is to pour on a few drops of the waxing solution, which is rubbed over with a piece of rag. After a few minutes' interval, polish it by means of a clean piece of flannelette, or other suitable material. The temporary support should receive this treatment some hours before it is required for use, in order that the turps—or other spirit—may entirely evaporate. In order to shorten the period, Abney has suggested the substitution of methylated ether, but I do not know that it is ever used instead of turps.

The temporary support being ready, the print (which should measure about 1in. less each way than its support) is squeegeed to it as if it were the final support, and

having been developed, rinsed, alumed, and rinsed again, it is ready for squeegeeing to the final support. This consists of a sheet of paper having a gelatinised surface. Let the final support soak half an hour or more before required for use. Now put a print which is on its temporary support face down into water at about 70deg. Fahr. ; under it, with its prepared surface up, slip a sheet of the final support, deftly bring the two into contact as explained on page 117, and place them upon a board, with the final support on top; the two surfaces are now brought into intimate contact by means of the squeegee. In using this, should the final transfer take place before the print has been dried, only a moderate pressure should be used ; on the other hand, a print which has been allowed to get dry upon the temporary support will need a very vigorous squeegeeing to the final support.

It should be added that the final support should be larger than the print, but *smaller* than the *temporary* support. The print should be hung up to dry, sunlight being, it is said, the best drying agent ; but any ordinary, not over damp, atmosphere will do. When the adhered sheets are quite dry, the temporary support should strip off ; should the surface of the print become slightly clouded after stripping, the cure is rubbing with methylated spirits. Instead of paper being used as the final support, wood, opal, glass, and many other materials are eligible ; while instead of using a paper temporary support, glass or zinc may be availed of. A favourite temporary support with old workers was the following :—Take a sheet of stout zinc free from blemish, and give it a fine and an even grain by means of a muller and sand ; then wax as already explained on page 121.

If glass is employed, shredded beeswax, 6gr. and methylated ether, 2oz., may be applied in place of the wax solutions already spoken of.

CHAPTER XV.

MODERN METHODS OF PIGMENT PHOTO-PRINTING.

DURING the past few years a strong fashion has arisen for employing various, what may be termed bichromated colloid processes, for the production of prints which, unlike those produced by the process described in the last chapter, are developed from the front of the sensitised surface. By this procedure no transfer is called for, the face of the print, after exposure, being simply washed with plain water, sawdust and water, or developed by means of a brush charged with water.

The main principle upon which the formation of the image depends is just the same as with the process in Chapter XIV.—that is to say, a soluble colloid (such as gelatine, gum, glue, albumen, and such-like substances) in the presence of potassium bichromate, or of some other bichromate of an alkali, is, after exposure to light, rendered insoluble. Those portions of such a film which are shielded from light action by the densest parts of a negative are entirely soluble; hence they are washed away in development. The partly shielded being partly soluble are partly washed away; the shadows are quite insoluble, or nearly so, and therefore not affected by the washing water.

In the transfer process of pigment-printing, the sensitised layer is of considerable thickness and of great opacity; hence, one reason, why it needs transferring and development from the back.

With the various bichromated colloid processes, to be presently described, one of the chief points as regards their efficiency is that the pigmented film shall combine, as far

as possible, transparency with vigour. That is to say, the printing light must be able to penetrate into the film, which, nevertheless, should contain a sufficiently dense amount of pigment to afford a full measure of the colouring matter needed for the strong dark shadows in the developed print.

The procedure in the processes under consideration is in the nature of a reversion to the early days of pigment printing. Poitevin in 1855, and Pouncy in 1858, both produced pigment prints developed from the front; whilst Blair in 1863 brought out a paper having a translucent surface composed of gelatine, albumen, and a pigment, which makes it much akin to what is now known as the Artigue Process. To Mr. Alfred Maskell is due a large amount of credit for reviving in England an interest in this rejuvenated method of working from the front of the film; for he, in 1894, lectured on and demonstrated the process before the Salon Conference, and thereby spread the knowledge of what had been done, since 1884, by M.M. Ladeveze and Artigue in the direction of perfecting the process.

As will have been gathered from the foregoing remarks, there are several modifications of the paper under consideration in use, some of which will be described with as much detail and accuracy as is possible and desirable. The reader must, however, remember that the processes are, as regards many of them, at the date of writing (April, 1897) in a transitory condition. Regarding others, the secret of the manufacture of the paper is not disclosed, and at present is only to be guessed at, for it cannot always be rightly discovered. The same remark, in some instances, applies to the method of developing.

The Artigue Papier Velours.—Of all the more or less similar papers now being brought to the front, this is probably the most popular, and certainly at present far the easiest to work. It is not yet manufactured in England, but can be obtained through any large photographic dealer in its unsensitised condition. It will be found to consist of a fine-surfaced white paper coated with a very thin black film, which is penetrable by light.

The paper, as sent out, is not sensitised. This has to be accomplished by the photographer. The task is, however, both simple and short, consisting of an immersion of the paper in a weak solution of potassium bichromate, the strength generally employed being 1 part bichromate to 50 parts of water. No particular care is called for except to avoid air-bubbles, to be sure the surface of the film is not touched whilst wet, and that the temperature of the bath is not over 68deg. Fahr. The time of immersion is stated to materially modify the sensitiveness of the film, the gradation and speed being increased by a longer immersion than normal, which may be taken to be two minutes. It has, however, been argued as regards pigmented colloids generally, and supported by experiments by Mr. G. H. James, that the time of immersion may be neglected, speed and scale of gradations being controlled by the strength of the sensitising solution. A strong bath means a fast printing surface: a weak bath means slow printing with an increase of contrast.

Whatever the time of immersion may be, the paper is, when taken out, hung up in the dark to dry, and printed from as soon as convenient after becoming dry. The best and usual plan is to sensitise over night for printing on the morrow. At the same time the sensitised paper will, with care, keep good for some time—a week or more—depending upon season, atmosphere, and its preparation.

The printing is performed as with the process described in Chapter XIV., an actinometer being used in order to judge the exposure. The speed of printing is, on an average, slightly greater than with the older "Carbon" process. No safe-edge is required, nor does any continuing action go on between printing and development.

The development is, in a considerable measure, akin to, but rather more difficult than is the case with, the transfer (carbon) process. The print is first soaked in warm water (temperature about 85deg. to 90deg. Fahr.). Within about twenty seconds a ghost image will appear; when this happens transfer the print to cold water (65deg. Fahr.), from which it should be taken and laid, face up, on a sheet of glass measuring an inch or two larger in width

and breadth than the print. Have ready a mixture of specially prepared fine sawdust and water, so compounded as to be about as thick as pea-soup, and at a temperature approaching 70deg. Fahr. Pour some of the sawdust and water along the upper edge of the print, so that a stream of the mixture runs across the whole of its face. The print can now be rinsed in cold water (60deg. Fahr.) and, if considered finished, alumed. Should, however, the print seem to require further "development," as is most likely, it can be subjected to repeated doses of sawdust. This field for judgment, taste, or control, is perhaps the chief obstacle to the widespread popularity of the process. In our days the demand runs very strongly in the direction of printing processes which are in a sense completely automatic, and in which the finished prints are incapable of much variation in colour, tone, or strength; wherefore the Papier-Velours is practically not likely to be extensively used by ordinary amateurs, or for the matter of that, by professionals. Nevertheless, given a fair measure of artistic temperament and training, the Papier-Velours will produce prints which are capable of a much better, much truer, and more pictorial rendering of subjects than probably any of the printing processes as yet discussed in these pages. On the other hand, with it one cannot turn out highest possible results by the score.

Development complete, the print is, after washing, finished by a quarter of an hour's bath in a 5 per cent. alum solution, which is used for the same purposes as with the transfer paper, viz., to harden the film and dissolve out the free bichromate salt. A rinse in cold water completes the procedure. Various means of specially controlling the character of the resultant image are available, chief amongst which is the use of a soft brush. To obtain plucky prints fully expose, using a thin, hot developer; for soft effects, do the reverse.

Mr. Maskell recommends as the most convenient vessel with which to apply the sawdust and water an ordinary coffee-pot, the developer being poured on to the upper edge of the print, and allowed to run down into any convenient receptacle—perhaps a common rectangular

“wash-tub” is as good as anything not specially made for the purpose. The kind of thing meant is as shown in Fig. 29. The “tub” is of common wood and can be purchased cheaply, G G G is a sheet of glass supported, if necessary, at S S, but in practice it will often be found convenient to rest the upper part of the glass on the side of the tub and let the lower be supported upon something standing at the bottom of the tub. At C C are two clips which hold the paper firm whilst the stream of sawdust and water is poured on. The sawdust, it should be added, is obtainable where the paper is got, and can be used over and over again.

The Gum Bichromate Process.—Perhaps this should be headed “Processes,” for the methods by which this class

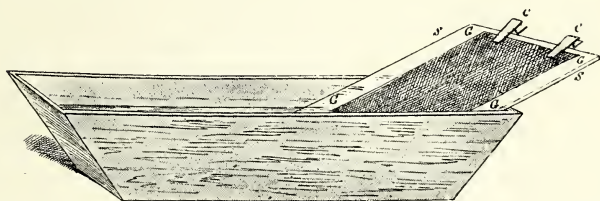


FIG. 29.

of paper is prepared seem to vary greatly, although no doubt all the variations depend upon the principles expounded by Mr. Pouncy.

For the following statement of the theory and practice of the process I am indebted to Mr. F. P. Wratten, A.R.C.S., whose recent researches in this particular department of photographic printing make his remarks unusually valuable.

The method of pigment process-printing, known as the gum bichromate process, is, perhaps, the most fascinating and wayward of all procedures connected with the Art of Photography. By its use the finest gradations of tone are possible, effects being obtainable which cannot be approached by any other known method of working. It

is wayward in the sense that it is practically impossible to get two identical prints from the same negative, and that the most experienced worker cannot tell exactly what result he will get until he has finished developing the print.

The process lends itself readily to local modifications of the proof; brush-work, jets of steam, and other manipulatory devices, rendering the image, if the preparation and printing of the paper have been successful, entirely subject to the taste and fancy of the worker.

It is remarkable, when one considers the beauty of the process, how little it has been improved upon since its introduction by Mr. John Pouncy in 1859. Such was the degenerate taste of those pre-Salonic days, that though results were obtained then almost equal to anything that has been obtained since, yet the introduction of the albumenised silver paper caused the bichromated gum process to fall into desuetude, and it was not until the last four or five years that it has been revived. Now, however, it bids fair to take the leading place amongst methods adapted to the pictorial rendering of the varied aspects of Nature.

Pouncy's Procedure.—The following are the original directions of Mr. Pouncy, and they form perhaps the best introduction to the practical working of his process:—

1. Prepare a saturated solution of bichromate of potash.
2. Prepare an aqueous solution of gum arabic, about the consistency of varnish.
3. Prepare vegetable carbon by grinding it with a muller on a paint stone, or slab, in the same manner that a painter grinds his colours; and be careful that it is ground very fine. It is to be ground with water.
4. Mix together equal parts of solutions 1 and 2, say, 4dr. of each to the ounce, and then add 1dr. of No. 3.
5. Stir the whole well together with a glass rod, and strain it through the finest muslin that can be obtained.
6. Now apply the prepared solution in the following manner:—Lay the paper face uppermost on a glass slab, or a very level and smooth board; the glass is the better of the two. Commence coating freely with a

broad camel-hair brush, laying on a copious supply over the whole surface, and then allow the paper to absorb the mixture for about two minutes.

7. This done, remove the superfluous liquid thus:—Take a painter's 4in. hog's-hair "softener" and work it regularly over the paper, with an alternate vertical and horizontal motion, until the whole presents a smooth, even surface, partially dry. The drying may then be completed by the fire. The preparation of the paper should be carried on by gas-light.

8. Expose in the usual way, varying the time according to light, say, about four or five minutes in the sun, and from ten to fifteen minutes in the shade. This, however, will be affected by the intensity of the negative, time of year, etc.

9. On removal from the pressure frame, lay the picture face downwards in a flat dish of clean water, taking care to exclude all air-bubbles. The time of soaking may be roughly stated at from five to six hours.

Comments.—It may be observed here that when the high light of the picture appears soon after immersion, the operator may conclude that he has under-exposed, or that his gum arabic is too thick, which last fault may be corrected by the addition of a little more bichromate. It is preferable to find the picture developing evenly all over. Each picture must be developed in a separate dish, and finally washed under a gentle stream of clean water from a tap or a lip-cup. Should the margin be not quite clean, pass a camel-hair brush carefully over it before rinsing from the tap, and, if needful, over any parts of the picture; but the best results are obtained by soaking only.

The following working hints and formulæ will perhaps prove useful:—

Colours.—The colours best adapted for practical work with the gum bichromate process are mixtures of red ochre, umber, and yellow ochre. These may be obtained at any oil-shop. For black, use the finest Paris black (obtained of any printer's-ink sellers), which should be prepared by grinding with a muller as directed by Mr. Pouncy. The ochres and umber should be freed from coarse particles in

the following way :—Stir up with water in a tall jug, allow to settle for thirty seconds, then pour off the supernatant liquid on to a piece of nainsook stretched across the mouth of a jar; the water runs off leaving the colour in the form of a paste. It should be kept so in a corked bottle ready for use, as if allowed to dry it cakes. The preparation of the pigments for gum bichromate work as above described was first suggested by Mr. J. Packham, F.R.P.S.

Gum.—Use the finest gum arabic. Do not in the course of dissolving heat the water beyond 150deg. Fahr., or the gum may partially decompose. When dissolved, strain through muslin, to get rid of foreign matter.

Preparation of the Paper.—The papers most suitable are those which combine strength with a somewhat roughened surface. Michallet paper, various papers by Van Gelder (specimen book may be had of Messrs. Grosvenor, Chater and Co.), and Papier Belleville are excellent.

The paper should be sized before use. The following is the best size known :—Take a solution of hard gelatine 1 to 60, and add to every 60oz. of the solution 7c.c. of a 1 per cent. chrome alum solution. Heat to 120deg. Fahr., dip the paper, and hang up to dry.

Coating the Paper.—This operation should be carried out by gas-light. Pin a sheet of the paper down to a drawing-board, then take equal parts of a solution of gum arabic—2oz., in water 3oz.—and of a saturated solution of potassium bichromate. Add sufficient pigment to make a mixture such that a thin coating of it spread on paper shall appear decidedly translucent when examined by transmitted light. Thoroughly mix the pigment with the solution, then filter through muslin. Apply to the paper as directed by Pouncy.

The paper may be dried by the fire, or be allowed to dry spontaneously, the latter being preferable. If dried by the fire, it is an improvement to have an acid present in the gum mixture; thus use equal parts of the following solution :

Gum arabic	...	...	...	...	...	2oz.
Citric acid	...	...	...	...	...	$\frac{1}{2}$ oz.
Water	...	...	...	...	...	15oz.

and of a saturated solution of gum bichromate. The acid accelerates the printing, and tends to give greater clearness in the whites.

Printing.—The printing is best done by strong diffused daylight, though with dense negatives it may be carried on in direct sunlight. It is a more certain method to over-print and develop by means of hot water than to normally print and develop with cold water: one is not so likely to be subjected to the annoyance of first seeing the half-tone develop nicely, and then vanish when one slightly raises the temperature, in order to get detail in the shadows. By looking through the print the progress of the printing can be perceived. Take the printing considerably beyond the time necessary to print the high lights; the exact time will be learnt by experience, and depends to a large extent upon the paper itself.

When the printing appears sufficient, immerse in water of 75deg. Fahr., for fifteen minutes; if development is then taking place, accelerate by running a gentle stream of tap water over the print. If the paper does not develop, raise the temperature gradually till it begins, and then continue development 5deg. below that temperature. The print may be supported on a piece of glass and the water poured over it from a cup. It is best to use plain water for development, expedients such as Artigue sawdust, or cotton-wool, having a prejudicial effect on the more delicate tones. The paper should be finally immersed in an alum bath, and then washed and dried.

Modifications in Procedure.—Although the directions given by Mr. F. P. Wratten in the foregoing notes are ample for the guidance of anyone who may wish to try his hand at the gum-bichromate printing process, and although, as I can testify, the procedure he advocates is capable of producing very charming prints, I append a resumé of certain variations in the preparation and treatment of this species of sensitised paper.

First we have that of Mr. Henneberg, who will be remembered as the exhibitor of several striking prints in last year's Salon. Briefly stated, his experiments led him

to the conclusion that a larger proportion of gum, and a colder development than is elsewhere advocated, is desirable. Thus a 40 per cent. solution of gum arabic and a saturated one of potassium bichromate are mixed in about the proportion of 1 part gum solution to 2 parts of bichromate. The order of mixing is to first incorporate the pigment with the gum and then add the bichromate. As an indication of the correct amount of gum, Mr. Henneberg advises that an unexposed strip of dry paper should be placed in cold water for thirty minutes; if at the end of that period all the coating is not dissolved off, the amount of gum is deficient.

The coating of the paper should be determined by the character of the subject to be printed. For a subject with coarse or bold contrasts a thicker covering is called for than where a delicate picture is aimed at. As a criterion of correct printing, the high lights should appear within half-an-hour, by simply soaking the print in cold water, otherwise over-exposure has ensued. Development is completed by a variety of expedients for washing the surface of the print, which is supported upon a flat sheet of wood, or other material. Thus water at various temperatures is availed of, a spray producer—one with a double ball action—being employed to apply a stream of water to such parts as require to be lightened.

A thin, rather soft negative having perfectly clear shadows is recommended. Where a separate sky is to be printed in, the print may, after drying, be re-coated with the gum bichromate, re-exposed under a cloud negative (the landscape being of course masked), and developed again. It was by this means that the prints in two colours by Henneberg in the 1896 Salon were obtained.

Some attention should be given to the kind of paper and to the make of pigment employed: thus the foreign experimentalists declare Whatman's and other English papers are less suitable than certain foreign makes. Those recommended before by Mr. Wratten, or the "Montgolfier" paper used by Mr. Demachez are suitable, as also are the drawing-papers made by Schleicher and Schull. This question of paper deserves more attention from experimenters. Certain of the English makes appear to be at

least as suitable as any of the Continental ones. In any case, a close-grained, more or less rough-surfaced paper should be chosen, and should be given a preliminary coat of a 3 per cent. solution of starch in water.

As regards colours, Winsor and Newton's or other good makes of moist water-colours—preferably those in tubes—are most reliable and convenient for those who do not care to grind, and otherwise prepare, their own pigments. The beginner is advised to keep to black, say, lamp-black, or ivory black. Next in ease of working are the blues, indigo and Prussian, less easy being the browns.

Regarding the gum to be used, some difference of opinion prevails. Ordinary gum arabic, special white gum, and gum acacia, all have their advocates. Again, whilst some advise that a preservative should be added to the gum to keep it "sweet," others state that the staler and more mouldy it becomes, the greater the sensitiveness of the resulting coating. In any case the gum should be filtered before using.

Whatever the pigment or the gum employed the working procedure may be as follows:—Use about equal quantities of gum in solution and of potassium bichromate; pour the gum into any convenient vessel, gradually add the moist water-colour, and thoroughly mix; finally stir in the bichromate.

The critical operation is to decide whether a given mixture has too much or too little gum. To test which experimentally coat a small bit of paper; when dry, the surface should show a "dull lustre." If the coating dries with decidedly shiny glaze, too much gum is indicated; if, on the other hand, the surface is much sunken in, the gum is insufficient. (See also Henneberg's test, before noted.) In the former case on development the image washes off, in the latter the half lights of the shadows refuse to wash off; hence the proportion of gum is a useful means of controlling gradation.

The coating is performed in yellow light—or gas-light—by means of a flat brush, fully, but not over fully, charged with the solution, which must be so applied that the paper can be seen through the partly translucent film. In order

that this may be as even as possible, directly the paper is coated the coating is smoothed, and thereby made more even, by being brushed over with a badger-hair softener such as is used by oil painters. This done, the paper should be quickly dried by artificial heat.

As regards the time of printing called for, this depends upon a variety of factors; but it may be taken that the printing is in rapidity directly as the proportion of bi-chromate, and as the actinic translucency of the pigment employed. Thus with a large proportion of gum longer printing is called for than otherwise. Again, blues print quicker than blacks; and these in their turn are faster than browns. Thus, if in a given light a blue image took ten minutes, a black would need twenty minutes, and a brown about forty minutes, or more.

To develop: the print should, in yellow or gas light, be soaked in changes of cold water until the free bi-chromate is washed out; this is known by the water ceasing to be tinged yellow. During this soaking, the high lights should begin to appear; in about five minutes, in the course of which the dish should be rocked, add warm water gradually, as seems called for, and continue accelerating the development by raising the temperature of the bath. After a time, the print should be finished off by placing it upon a sheet of glass, zinc, or other material, and continuing development as with the transfer pigment process. Should there have been over-exposure, the development will probably hang fire, in which case recourse may be had to the sawdust and water already described for use with the Artigue Papier-Velours. Some practitioners "help" the print by means of soft brushes, which are employed to remove superfluous deposits in the shadows, or elsewhere. In order to do this, the print should be re-immersed in water to the depth of about a quarter of an inch.

The photographer who uses the foregoing paper, knowing what pigments have been employed in its manufacture, is the more easily, and more successfully, able to retouch or work up the print, by using the self-same mixture without the bichromate.

In conclusion, the experimenter in this newest of all printing methods is advised to keep as many of the factors which go to the making of the print constant; that is to say, he should use one kind of paper, pigment, and mixture, and experiment with one negative of suitable character. As regards exposure, which is liable to enormously influence the resultant print without the photographer suspecting it, I can only once more strongly advise measuring the light action with an actinometer, and giving prints from the same negative a series of different exposures. Let me add that an over-exposure seems less harmful than an under-exposure.

A New System of Coating Gum Bichromate Paper.

—Since the foregoing particulars were written a notable step forward in the method of preparing the light sensitive surface of the gum bichromate paper has been published, which adds considerably to the certainty with which results are attainable.

All who have hitherto attempted to print with the gum bichromate paper are aware of the annoying vagaries of the process. Hard prints, stained high lights, a coating which during the drying of the print is apt to run together and blot out the needful form and detail of the image, are but a few of the vexatious troubles which are capriciously present. These have been to a large extent overcome by the expedient which Messrs. Maskell and Demachy, in their lately published little book on "Photo-Aquatint," describe, and which consists in coating the paper first with a 10 per cent. solution of potassium bichromate, followed by a coating of pigmented gum.

A further advantage which accompanies this last suggested method of preparing the paper, is a considerable increase in the sensitiveness of the printing surface. Some claim that the sensitiveness is three times as great as with the former method of coating the paper. The writer estimates the sensitiveness of the new to the old makes of paper as 2 to 1.

Messrs. Maskell and Demachy's directions are brief but explicit, although evidently not final. They advise that the paper should be soaked for about two minutes in a 10 per cent. solution of potassium bichromate. When perfectly

dry, a 20 per cent. solution of gum, mixed with as much pigment as is found requisite, is applied in the manner already described, *i.e.*, by means of a fan-shaped hog's-hair brush followed by a "badger sweetener" to soften and equalise the coating.

Paper so prepared may be impregnated with the bichromate for weeks before being used, providing it is not exposed to much light. The liability to deterioration only supervenes when the pigmented gum is applied.

Development follows the usual course.

Modifications of the New System.—As suggested in the preceding paragraphs, Messrs. Maskell and Demachy's departure is but the beginning of a fresh series of improvements. It is too early to discuss, or epitomise, all the modifications which have been tried. Of those which have come under the writer's notice, the most valuable seems to be the method of procedure adopted by Mr. Packham, *viz.*, instead of soaking the paper in a 10 per cent. bath he uses a *hot saturated solution* of potassium bichromate, in which the paper is immersed. When dry, the minute crystals, which will have formed upon the surface, are brushed off, and the paper, which, originally white, is now of a pale mustard colour, is put by ready for coating with the pigmented gum. An innovation in development is the use of water at 212deg. Fahr., instead of the maximum advised by Mr. Maskell, *viz.*, 100deg. Fahr. The results indicate that, by adopting Mr. Packham's methods, prints having considerable sharpness and vigour are producible.

Concluding Remarks.—Many variations in utilising the promising possibilities of the gum bichromate processes will no doubt occur to the student, to whom a fascinating field of experimental research is opened up. To those who intend to familiarise themselves with the processes above described, no better first step could be taken than the following:—Impregnate a sheet of not too smooth, but nevertheless even grained, paper with potassium bichromate; paint on (no great evenness is called for) a mixture of gum and pigment of a suitable consistency (*see ante*); when dry, proceed to print through the *back* of the prepared paper. Develop with hot water.

CHAPTER XVI.

FACING, BACKING, AND MOUNTING.

PRINTS may be finished with a surface which is either (1) natural, (2) matted, (3) burnished or glazed.

Not all papers are susceptible to, or suitable for, either matting or burnishing, and in any case the treatment required by different makes of paper is somewhat varied. By "natural finish," is meant that which the paper possesses when merely mounted, without any attempt being made to alter the normal character of the surface of the print. As a general rule, the surface of a paper is best left alone, reliance for any desired finish being as far as possible placed upon the paper having either a rough or a fine texture. Thus with bromide paper one has a choice of smooth, matt, rough, and extra rough surfaces. A similar but rather more restricted selection is available with platinotype, "carbon," and silver print-out papers. None the less it is impossible to deny that many a time a print is distinctly improved by being on the one hand matted, or, on the other, enamelled.

Without entering deeply into the æsthetics of surface, it will suffice for the present purpose to lay down the general maxim that fineness of surface should be proportionate to the size of (a) the print, and (b) the details upon which the interest may depend. In any case admirers of pictorial art invariably prefer a surface not glazed; whilst those who value photography for its elucidation of matters of scientific fact give their preference to a highly enamelled print.

The reasons for these preferences are not far to seek. With a glazed surface the idea of distance is largely destroyed, and the illusion whereby depth and form are

suggested to the eye is to some extent done away with. A roughened surface does not, as it were, interpose a definite barrier between the picture and the beholder. Moreover, the more or less fine granular surface of the paper, by breaking up the light reflected, greatly helps in the simulation of the conditions found in Nature, where light and shade are not confused with vexatious surface reflections.

On the other hand, a highly glazed surface is beyond question best fitted to bring out every scrap of detail which has been impressed upon the negative; hence, where the the object in view is to present as many facts as possible, by all means burnish the photograph to the highest possible degree.

It does not follow that the photographer who desires his print to possess pictorial art quality should adopt a paper which is as rough as can be got, for, as already stated, this roughness ought to be proportionate to the size of the print. Other things being equal, a print's dimensions regulate, or should do, the distance at which the beholder stands when he is looking at it. Now, apart from the question of the sacrifice of detail which follows the use of very rough-surfaced paper for the printing of a *small* picture, under such circumstances the grain of the paper must needs be unpleasantly obtrusive when the print is viewed from its proper distance. Hence one may safely lay down the rule that no paper shall be used of which the grain is recognisable at the normal distance for viewing a print.

What, it may be asked, is a normal or correct distance? Apart from all questions of abnormal sight, the correct distance has been given as the equivalence of that of the lens when the negative was taken. Thus, if a lens whose focal length is 6in. be employed to obtain a print measuring, say, $2\frac{1}{2}$ in. by 3in. one should view the print from a distance of 6in., which is equal to twice the print's longest dimension. Hence if *the same* negative be enlarged to 5ft. by 6ft. the proper standpoint would be 12ft. away.

The foregoing is, without doubt, often a very useful method of deciding upon a critical standpoint for viewing; but, obviously, however much there may be as regards theory to recommend the expedient, in practice it cannot

always be followed. Thus on the one hand a 3in. lens will cover a $\frac{1}{4}$ -plate. Again, a pinhole, whose distance from the plate may not exceed 2in., might cover the same size. In these cases it would obviously be a physical impossibility to apply the above rule. Again, with a telephoto or similar combination the length of focus is so great that a $\frac{1}{4}$ -plate print would be grotesquely too far away for the proper examination of a reasonable amount of its finer detail.

Perhaps for ordinary purposes the distance from which to view a print may be reckoned as being once to twice the length of the picture's diagonal. With a $\frac{1}{4}$ -plate twice the diagonal may be taken (say 10in.). With $\frac{1}{2}$ -plate or whole-plate take $1\frac{3}{4}$ the diagonal with 10 by 8; multiply the diagonal by $1\frac{1}{2}$. In any case, whatever the distance adopted for the point of sight, when you stand before your print, and see all the detail which you mean should be visible, the grain of the paper should not be discernible.

Matting.—The papers which best lend themselves to this, and which most frequently call for such treatment, are those known as silver papers, such as gelatino-chloride, collodio-chloride, albumenised, and bromide papers. As regards all these, paper is procurable for printing on which is sent out *ready matted*. That is to say, the paper has a dull, finely granulated surface which is entirely free from glaze. This is often very convenient to use, as saving both time and trouble. But where results of the highest technical quality are aimed at, the ready-matted paper should be avoided, for not only is there, especially with small prints, a noticeable loss of detail, but the finished print is apt to be distinguished by a not attractive sunken-in appearance.

Where an ordinary smooth or glazed surface is in the first instance printed upon, it can well be imagined that the detail is ever so much more sharply imprinted; and, moreover, the image is formed mainly upon the very top of the face of the paper. The subsequent alteration which follows matting is merely a physical one; the image is as much as ever on the surface, as sharp as ever, but the surface itself, instead of being smooth, is roughened.

Fortunately no very great difficulty is met with in the process of matting. Take the case of gelatino-chloride paper. The finished print may be, if hardened by means of alum, formalin, or other means, taken direct from the washing water and straightway applied to a sheet of ground-glass, or other roughened surface. Where, however, the paper has not been specially hardened, the print should be first allowed to dry; when quite dry, it is rewetted and squeegeed. In any case, this drying and rewetting is a wise precaution, and hardening is also advised.

Squeegeeing is performed as follows:—The print being face downwards in a dish of water, a suitably prepared sheet is slid under the print; the two are then drawn out (*see* page 117), and complete contact is ensured between the two surfaces by means of a rubber squeegee, vigorously applied to the back of the print. In performing this operation, it is usually advisable to interpose a sheet of india-rubber or American cloth between the back of the print and the squeegee. If, through the presence of enclosed air or water, any small patches of paper are not in contact, those particular portions will differ from the rest.

In matting various surfaces are employed, most in favour being either ground-glass or prepared xylonite sheets. The former differs a good deal in the size and regularity of its grain. For most purposes, a fine grain is advisable. The xylonite or celluloid sheeting is often preferred as being cheaper, more durable, and more compact.

If either of the latter substances be used, rub it over with 1 part of ordinary resin ointment to 9 parts of turps, after which polish. Should ground-glass be adopted, it is of the utmost importance that the glass should be *perfectly clean*. It should be well washed in clean soap and water, followed by a second solution in water. When dry, a little vaseline may with advantage be applied to the plate, which is then rubbed until the vaseline is nearly cleaned off.

The most popular application to glass for preventing the permanent adhesion of a squeegeed print is what is known as “French chalk,” which is, however, not chalk at all, but a kind of powdered talc derived from the heavy and hard

form of silicate of magnesia. It is probably through amateurs getting hold of levigated chalk, instead of the above, that many spoilt prints are due.

In preparing glass with the powdered talc, or French chalk, the glass being quite clean and dry, rub the talc over the whole surface with a piece of clean flannel, dust off all superfluous talc with a soft camel-hair brush, and the glass is ready for squeegeeing. Before leaving the subject of matting, let me add that any bright patches, due to parts of the print not having been in contact with the roughened surface, may be doctored by rubbing the face of the print with a little powdered pumice-stone. This last is also often used where it is desired to quickly matt an ordinary print. Some of the powder rubbed on with a circular motion, by means of the finger-tips, soon turns a glazed print into a dull-surfaced one, with a general lowering of tone.

Enamelling Prints.—A brilliant shining surface to prints is attained by squeegeeing them on to either ordinary glass or on to sheets of ferrotype. The glass must be cleaned and talced as above described. The ferrotype sheets need not, as a rule, be talced; but should they be dirty, or the surface of the print be softer than usual, there is some risk of sticking. In place of the other preparations recommended, a mixture of 24gr. of spermaceti wax incorporated with 4oz. of benzine may be used. Cover the glass with a little of the above, applied with cotton-wool, and polish off with a soft cloth.

The above remarks, primarily referring to gelatino-chloride paper, are also, in the main, applicable to bromide, collodion, and albumen papers.

“Carbon” (photo-pigment process with transfer) prints may be given a matt surface by rubbing with cotton-wool dipped in turps. Or a brighter surface than that yielded by the ordinary smooth paper is attainable by using equal parts of white wax and turps as an encaustic paste, after the manner of burnishing silver prints with a hot roller.

Should it chance that a gelatino-chloride print refuses to strip when dry—and all prints should be *completely* dried

before any attempt is made at detaching them from their support—use moderate warmth, which will often bring away the print. If this fail, lay the support on a flat horizontal surface, and rub formalin over the back of the print until the whole is completely saturated; when dry, the print will strip.

Backing Prints. — Where prints — more especially gelatino-chloride ones—have been squeegeed, some precaution in mounting them is necessary to prevent the surface from being injured by damp, or by direct contact with a part of the mountant. Some people use cut-out mounts, and are satisfied by merely touching the edges with a strong starch, gelatine, or “waterproof,” mountant. This is hardly a satisfactory method. Another expedient



FIG. 30.

is to stick the mount on to a previously trimmed print whilst the latter is squeegeed down to the glass. This is possible with a neat and skilful hand, but is none the less a very uncertain practice. Best of all is to paste upon the back of the untrimmed print, when it has been squeegeed and is about half dry, a sheet of waterproof backing, which dealers supply cut to stock sizes for the purpose. When the print is stripped from its glass, or ferrotype, support, the backing should be in firm contact with it.

Those who cannot obtain the above backing may adopt the following substitute :—Coat any suitable chemically pure paper with the gelatine mountant described on page 145, and allow to dry. For use, soak the gelatinised paper for a few minutes in water, and when the squeegeed print is

about half dry, the gelatinised surface of this home-made backing is squeegeed on to the back of the print.

The print when stripped may now be trimmed and mounted in the usual way.

Mounting.—Respecting this, much might be written, but may not in this little résumé. As regards the decorative and emphasising effect of the surround, nothing can be here even attempted, except to say that no one pattern of mount or frame can by any possibility suit all prints. Mounts, particularly when used for silver prints, should be free from noxious chemical substances, especially acids, which are likely to destroy the print in part or whole. As regards trimming only these remarks: be sure that the top and bottom edges of the print are parallel to the horizon, and that the sides of the print are parallel to any perpendiculars which may happen to be found in the picture; do not think that all subjects may with advantage be cut to the same size. Thus a sea-piece, Fig. 30, would be

all the worse if about three times as high as in sketch; on the other hand, a picture such as Fig. 31 would obviously be mangled if cut down to such proportions as Fig. 30.



FIG. 31.

The appliances for trimming are many, or not, just as circumstances may dictate. All that are absolutely needed consist of a straight-edge and a sharp-pointed knife. Wooden or other "cuttable" straight-edges are the least desirable; a metal one is as good as many; one having two arms at right angles is very convenient (Fig. 32). If it be marked in $\frac{1}{4}$ in., so much the better. Most amateurs, however, prefer glass slabs, which are procurable cut to ordinary sizes. A cobbler's knife is rather better than a penknife, although the latter, if properly handled, will do good work. Great need exists to see that the knife is well sharpened. A stone should be kept handy on which to occasionally "fetch up" an edge; failing which, fine emery

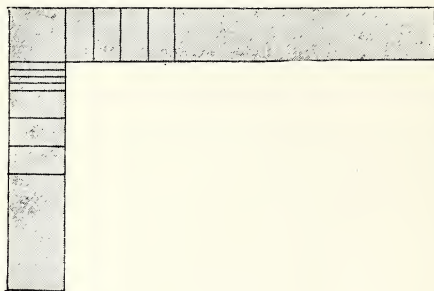


FIG. 32.

glued on to a strip of wood, followed by a stropping of the blade over a piece of smooth hard wood will be found serviceable. Wheel-cutters are also useful, especially for trimming wet prints, but it is not everyone who

can get hold of the knack of using them. In order that trimming may be effectively carried out, a hard level surface is needed. Wood does not, as a rule, answer, on account of its grain. Cardboard does fairly well for a short time, but soon gets cut up, and is then unusable. Many give a preference to a flat sheet of zinc, which is hard to beat; glass, especially plate-glass, is also very good, but quickly blunts a knife.

Mountants may be divided into all kinds of categories. Perhaps our purpose will be best served by considering them under commercial makes, and home-made ones.

The great enemy to all prints is acidity; this, when accompanied by damp, will usually cause irreparable

damage, more especially with the silver prints. Ready-made mountants contain, in one form or another, what is called a preservative, or an antiseptic, which is intended to prevent the adhesive from "turning sour" or "going bad."

Of the ready-made articles, all having a gum basis should be rejected, or viewed with the greatest suspicion. Of those dependent upon gelatine, which usually have a strong jelly-like consistency and appearance, and are generally used in a warm condition, the photographer may be more tolerant. Indeed, in some cases the use of a hot solution of gelatine is unavoidable. Nevertheless, for reasons too numerous to mention, and not always rightly known, the gelatine mountant is at times the immediate cause of prints being badly marked. Mountants having a starchy or dextrine basis have lately come to the front in the form of Higgins' Photo-Mounter, and similar preparations; these are the best class of mountants which the photographer can use. The chief fault with the aforesaid, and many others of the same character of pastes, is that it dries too rapidly. Hence if a large print—say, 15in. by 12in.—has to be mounted, the first portion of the applied paste is apt to become partly set before the print can be rubbed down on the mount. In such a case irregular adhesion is likely to ensue. Rather better, where large prints have to be mounted, is the Agalma Mountant made by Woodcock, of Croydon. Both the above keep in good condition for many weeks. Home-made mountants are, in practice, restricted to either the gelatine or the starch one. The former is made as follows:—cover Nelson's, or other pure, gelatine with a little water; in about an hour the gelatine will have absorbed the water, and swollen up. This done, add sufficient hot water to the above—about 4oz. of water to $\frac{1}{2}$ oz. of gelatine; rather more water may be used if the prints to be mounted are large; and are upon thin, smooth paper. The above will keep for a few days after mixing, dependent upon the strength of the preparation and the temperature. A stiff gelatine solution will remain good for perhaps a week during cold weather; a thin one may begin to deteriorate in two days or less when the temperature is above temperate. The addition of carbolic acid,

or other preservative, adds to the keeping property of the above. The foregoing is, when cold, too stiff, and quite unavailable for mounting; it is therefore used hot. If kept in a small jam-pot, the latter can be stood in hot water contained in a penny tin saucepan supported over a spirit-lamp.

Best of all is the home-made starch mountant, which should be mixed as wanted:—Make $\frac{1}{2}$ oz. of Glenfield or similar white starch into a stiff paste with a little cold water; then gradually add 6 oz. of cold water; heat the mixture, keeping it constantly stirred, until it has thickened and become translucent, which it will do when approaching boiling-point. The resultant product should be, whilst still hot, rather thinner than treacle; when dry, it should be a pale blue, almost white, jelly-like substance, which should easily and smoothly cover paper or cardboard when applied with a medium stiff brush.

In mixing the above one should vary the proportion of water according to the object in view. A heavy, rough paper will need a stiffer starch than will a print on thin paper. An extra large print should be mounted with a rather thinner paste than the average, so that unequal drying may not ensue.

In mounting the procedure is much varied, according to circumstances of print and mount. With small prints—up to $\frac{1}{2}$ -plate—a most convenient course when using starch paste is to apply the mountant to the mount, having previously marked with four pencil dots the positions which the four corners of the print should occupy. The print, either wetted and blotted off, or, as circumstances advise, applied dry, is put into position, covered with a sheet of clean blotting-paper, rubbed into partial adhesion with the hand, quickly examined to see that all is right, and then pressed into intimate contact by means of a squeegee, or a piece of hard wood having a smooth rounded straight edge applied over a sheet of paper. Should any of the mountant squeeze out of the edges of the print, remove with a clean handkerchief; while should any portion of the edge of the print lack paste, apply a little by means of a small brush. The print may now, if surface dry, be

covered by a sheet of clean board or paper, and placed under a medium weight to dry. When possible, large prints should be wetted, blotted off, and the mountant applied to their backs, the mount being first *slightly* damped, to prevent undue inclination to curving inwards, which otherwise happens.

CHAPTER XVII.

PAINTING AND CRAYON WORK ON PRINTS.

It is almost, but not quite, needless for me to remind the reader that at the present moment there are several different makes of paper in fairly general use, and that each one of these requires to be treated with special discrimination as regards its preparation for receiving crayon or colour.

Bromide Paper.—This is perhaps the kind of paper which is most likely to engage the worker's attention, because, even with contact prints, it usually calls for help oftener than is the case with other sensitised papers. Being moreover very frequently employed for enlargements, the necessity for touching-up and the facility with which the operation is performed, are reasons why "bromides" are probably oftener fortified with brush-work than all other kinds of photographic prints put together.

Prints are generally black in tone, but, in a few cases, may be brown; the surface is nearly always slightly rough, but sometimes very rough, or very smooth.

The normal bromide print is easily worked upon with Conté's crayons, and similar pigments. No. 3 of the before-named is employed for shadows; Nos. 1, or 0, for lighter touches. A stump will be found useful—indeed, necessary. Pastels, whether hard or soft, may be with considerable advantage utilised when the colouring of an enlargement of a portrait is called for. In both the above cases the surface of the print may be given a tooth by rubbing with fine pumice-powder.

The "Dictionary of Photography" states that "for water-colours it is advisable to gently rub the surface with a pad

of fine linen or cotton-wool dipped in weak ammonia water, so as to make the colours take; or diluted solution of oxgall may be used for the same purpose. The enlargement must be absolutely dry before the colour is applied, or blisters and running of the colour will ensue."

Where oils are to be used, the foregoing advises: "Obtain one pennyworth of clear size and dissolve in a pint of warm water, and flow over the enlargement just as if one were coating a dry-plate. The film must not be touched with the fingers. When quite evenly covered, set the canvas up about 4ft. from the fire to drain and dry, when it will be found that the oil colours will take well, and yet not sink in or stain the paper or canvas."

This method is available for painting in full body-colour upon the print. In some other cases, fairly satisfactory effects are obtainable with the outlay of but little time, by merely tinting the enlargement with transparent oil colour, the pigments being applied with a liberal amount of medium. If needs be, the picture is finally touched up with a little body-colour.

Mr. A. H. Bool, in his "Art of Photo Printing," recommends aniline or liquid dye colours as capable of producing pleasing results in tinting; weak washes are applied one over the other until the sought-for effect is obtained.

Where a monochrome bromide print is to be touched up in water-colours, liquid Indian ink will be found very serviceable.

The following medium, for mixing with water-colours, used for painting on bromide paper, is advised by "Mahl-Stick," writing in *The Bazaar*:

Oxgall	...	...	...	...	...	30gr.
Glacial acetic acid	...	...	...	...	...	30 minims
Distilled water	...	...	...	...	...	3½oz.
Rectified spirit	...	...	...	...	...	1½oz.

This may also be employed in painting bromide opals.

Yet another formula is given in the *Photographic News*, No. 8, Vol. XL. I have not personally tested this; but it has every appearance of being an effective application. 45gr. of quillia bark are shaved up, and soaked in 1oz.

of water for twelve hours, then filtered, after which 1oz. of alcohol and 4gr. salicylic acid are added. The print, being covered with a wash of the above, is, when dry, ready for colouring. Cross-hatching and stippling are recommended where the above is availed of ; but no doubt light washes might well be applied.

An experienced worker-up of bromides in monochrome, Mr. L. G. Bigelow, has found the following system to be both rapid and effective :—Mix 1 part of megilp to 2 parts of ordinary tube oil colour (he prefers blue-black for the ordinary bromide print). The foregoing, by means of a flat hog-hair brush, is rubbed in, as in stump-work with crayon, using but little of the colour. Next proceed to blend and modulate by dabbing with a round bristle brush ; fortify parts needing it with a further application dabbed on, following with another application of the bristle brush, which should produce a kind of stipple, varying in grain with the strength used in dabbing ; finish small dark shadows with a sable brush. These finishing touches should be stippled down to keep them in harmony with the rest of the work. The above should be completed at one sitting. Wiping out and quasi-hatching may be effected with a rag used over a stump.

Occasionally one meets with bromide prints which have been toned brown by means of an uranium bath. If the above are wetted, especially with an alkaline fluid, the brown colouring becomes destroyed, a patchy print resulting. In such a case, immerse the print in weak ammonia and water, rinse, and dry ; the print will then resume its original black colour, and must be treated like any other black print. It is, however, quite easy to restore the brown tone by re-immersing the print in the uranium toning solution. (*See Chapter XIII.*)

Carbon Enlargements.—These, if to be worked upon with oil, will first need mounting upon a stout cardboard, or, better still, to be transferred by the photographer to canvas, and strained upon an ordinary stretcher. A transparent, or nearly so, priming is called for, such as thin starch, to which some gum has been added. What is known as tinting in oils—*i.e.*, applying thin glazes of transparent

colours—is sometimes resorted to with carbons, which need no priming for such purpose; in most respects they may be handled much as are bromide prints, which *see*.

Water-colours employed to improve carbon prints are often availed of as follow:—the print usually needs some slight preliminary preparation. Mr. Johnson advises the artist to “rub lightly with a flat piece of india-rubber or ink-eraser, provided that the ink-eraser is not hard enough to scratch, then wash with a sponge and cold water. If the water will lie evenly, you may consider there is no grease.”

The print should be carefully dried, avoiding much heat, which might crack or blister the film; when quite dry, a sharp steel eraser is used to reduce shadows considered too black, and to soften edges. Should the lights and half-lights be too white, a suitable half-tone mixed with a little gum-water may be applied. The print should next be re-spotted, then worked up with stipple and hatch, the eraser being again used to take out lights. Finally, some of the dark shadows gain immense force by being touched up with weak gum-water (gum arabic dissolved). This use of gum must be sparing.

Crayon Finishing of Carbon Enlargements, etc.—

In order to give a suitable tooth for the crayon, it is needful, where the print is made upon a smoothly surfaced paper, to roughen the surface. For this purpose, Mr. Johnson, in his book elsewhere referred to, advises the use of fine pumice-powder. A little of this is shaken over the print, the latter is then given a tap, with its surface perpendicular, so that the coarser particles of pumice fall off; those which from their minuteness are left on are to be rubbed smoothly with the palm of the hand, until the whole surface has a distinct and even “tooth.”

Carbon enlargements are frequently made upon a fairly rough-grained Whatman, or similar drawing-paper; in such a case the above preliminary roughening is uncalled for. As before directed, over-black portions are scraped down, care being taken to avoid scratching—a slight granularity, however, need not be feared. Those light portions which require toning down are next stumped over

with powdered chalk, using bread, where needful, to take out lights or half-lights; finally work up with crayon—a blunt-pointed one is recommended by Mr. Johnson, who also speaks favourably of Perry's solid black ink crayon as being eminently suited for working up black carbon prints.

Platinotype is much more amenable to colouring than are most papers. In many cases no preparation is called for; but most artists will find that it is worth while to give the print a weak coat, consisting of a piece of parchment size dissolved in three times its bulk of hot water.

Gelatino-Chloride Paper.—Of this there are two leading varieties—matt surface and smooth—the latter kind being sometimes highly burnished. The surface of the burnished paper is very easily injured by moisture, and does not readily take water-colour—indeed, quite the reverse. The following recipes of Mr. J. Joe, having been practically tested, will, however, be found to overcome all difficulties. After fixing, the prints must be hardened in an alum bath, and spotted with colours mixed with albumen; but the essential part of the process is to flow over the mounted print filtered albumen to which a few drops of ammonia have been added. When the print is fairly dry, pass it through a burnisher. This coating of albumen will receive all ordinary water-colour. With these, however, it is recommended that some albumen should be incorporated, although this is not, in all cases, essential.

For glazing, liquid colours are best used; while for body-colour working, powdered pigments, mixed with the following:

Filtered albumen	...	...	...	...	100c.c.
Ammonium carbonate	...	...	...	...	5 grammes
Glycerine	...	...	...	...	3c.c.
Liquid ammonia	...	...	...	...	4c.c.
Water	...	...	...	...	25c.c.

The above keeps well after being thoroughly heated; the colours mixed with it take well, and are sufficiently transparent.

Tinting gelatino-chlorides with oil colours is a perfectly

simple, and often satisfactory, process. Either a matt or glazed print may be operated upon, but preferably the former. The print should be hardened and mounted before being worked upon. As a rule, only transparent colours should be used, these being thinned with megilp or other suitable medium and applied with fine sables. Should the surface dry unevenly as regards glaze, the print, when quite dry, must have a little megilp rubbed over the whole of the surface; or copal varnish may be utilised. The most suitable procedure to adopt will depend upon whether a glazed or matt print is being dealt with. In the former case plenty of megilp and varnish may be called for: in the latter a considerable proportion of "turps" should be mixed with the megilp and colour, to ensure the paint drying with a non-shiny surface.

Albumenised Paper.—This is the old-fashioned printing process, now becoming so uncommon. Mr. Johnson, in his book on "The Art of Retouching," considers that it is sufficient to "wash surface with clear water, which should cover every part readily before you attempt to add colour. If the print seems to be greasy, put a small touch of oxgall into the water." It is to be added that not more than enough water should be applied to get the surface amenable to pigments, care being taken not to injure the albumen film; the print should, of course, be dry before any colour is applied. Where a large surface has to be covered "Mahl-Stick" advises a weak solution of isinglass, to which is added a few drops of spirits of wine; or a coating of the following may be applied:

Purified oxgall	...	...	...	...	1dr.
Distilled water	...	...	...	...	7oz.
Rectified spirits	...	...	...	...	3oz.
Carbolic acid	...	...	...	...	10 drops

When it is needful to counteract a tendency to drying dull, which is frequently the case, the following medium may be with advantage resorted to:—Dissolve $\frac{1}{2}$ oz. of white gum arabic (the best procurable) in just enough water to cover it. It will require some considerable shaking and time for the solution to become complete; when it is

so, strain through muslin and add 6 drops of glycerine, and a piece of camphor about the size of a filbert. Sufficient of the foregoing is added to the colours at time of using. When albumen prints are to be painted with oil colours, a priming of warm size should be first applied.

Generally as regards all prints to be operated upon it should be borne in mind that, according to the pigment used, and to the material which supports the photographic image, will the necessity arise for priming the photograph. While, in some cases, a priming is applied so that glazing or tinting colours should flow over the surface, in other cases the priming is such as to allow of a certain proportion of the applied pigments to bite, but not to unduly sink into, the substratum of paper, wood, canvas, or what not. Apart from parchment size, which is not always available, nor in all cases free from contamination, a weak gelatine is useful. Very frequently, where oil colours are to be employed, the print is soaked in tepid water, then immersed in a warm solution of thin, clear, freshly-made starch until well saturated, which should not take more than a few minutes. It is best, on taking the print out of the starch, to straightway mount it, and at the same time remove any superfluous starch from the print's surface. In availing himself of the above the amateur will, of course, bear in mind what is the character of the print he is handling ; thus some bromide prints, unless hardened, would hardly take kindly to hot solutions, nor similarly would gelatino-chloride prints. On the other hand, no harm should come of subjecting albumen, platino-type, or collodio-chloride prints to such treatment as above recommended.

WEIGHTS AND MEASURES.

Apothecaries' Weight.

20 grains	= 1 scruple
60 grains	= 3 scruples = 1 drachm
480 grains	= 8 drachms = 1 ounce
5760 grains	= 12 ounces = 1 pound

The above are used by chemists in making up medical prescriptions, and are also supplied with most sets of chemical balances which weigh grains. Drugs and chemicals are, however, sold by Avoirdupois Weight.

Avoirdupois Weight.

437.5 grains	= 1 ounce
7000 grains	= 16 ounces = 1 pound

This last system is that by which photographic formulæ are usually prepared.

Fluid Measure.

60 minims.	= 1 drachm (fluid)
480 minims.	= 8 drachms = 1 ounce (fluid)
9600 minims.	= 20 ounces = 1 pint

The Metric System.

In this the unit of solid measure is the gramme = to 15.43 grains. Hence dividing grammes by 4 we approximately get the equivalent value in solid drachms (Apothecaries' Weight), *i.e.*, 4 grammes = 60 grains (actually 61.7 grains) = 1 drachm (nearly).

Similarly to approximately convert grammes into Avoirdupois ounces we divide by 28.0; for 28 grammes = 432 grains, the ounce Avoirdupois weighing 437.5 grains. Hence a $\frac{1}{4}$ ounce will equal about 7 grammes.

Metric Measures of Weight.

10 centigrammes	.	.	= 1 decigramme
10 decigrammes.	.	.	= 1 gramme
10 grammes	.	.	= 1 decagramme
10 decagrammes	.	.	= 1 hectogramme

Fluid Metric Measures.

For scientific purposes the usual unit is the cubic centimetre (c.c.), also called millilitre, equal to 17 minims (nearly). Hence dividing cubic centimetres (c.c.) by 3.5 we approximately get their equivalent in fluid drachms, *i.e.*, $3\frac{1}{2}$ c.c. = about 60 minims (actually 58.8), which equal 1 drachm. Conversely, on multiplying fluid drachms by 3.5, their approximate equivalent in c.c. is obtained.

1 cubic centimetre	.	.	= 16.8 minims
1 litre	.	.	= 35.216 fluid ounces
1 fluid ounce	.	.	= 28.4 cubic centimetres(c.c.)

Metric Measures of Capacity.

10 millilitres (or cubic centimetres)	= 1 centilitre
10 centilitres	= 10 cubic centimetres = 1 decilitre
10 decilitres	= 100 cubic centimetres = 1 litre
10 litres	= 1,000 cubic centimetres = 1 decalitre

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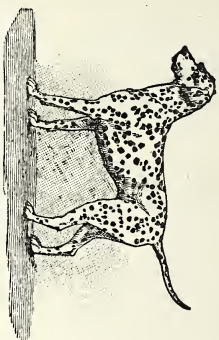
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